

The status of Aboriginal water holdings in the Murray-Darling Basin

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The status of Aboriginal water holdings in the Murray-Darling Basin

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Acronyms and abbreviations

ACT	Australian Capital Territory
ALRA	<i>Aboriginal Land Rights Act 1983 (NSW)</i>
BDL	Baseline Diversion Limit
BR	Basic Rights
DELWP	[Victorian] Department of Environment, Land, Water and Planning
DEW	[SA] Department for Environment and Water
DNRME	[Queensland] Department of Natural Resources, Mines and Energy
DPIE	[NSW] Department of Planning, Industry and Environment
D&S	Domestic & Stock [NSW water entitlement]
ERP	Estimated Resident Population
GL	Gigalitre
GS	General Security [NSW water entitlement]
HS	High Security [NSW water entitlement]
ILC	[former] Indigenous Land Corporation
ILSC	Indigenous Land & Sea Corporation
LLS	Local Land Services [NSW Government agency]
LTDLE	Long-term diversion limit equivalence
MDB	Murray-Darling Basin
MDBA	Murray-Darling Basin Authority
ML	Megalitre
MLDRIN	Murray Lower Darling Rivers Indigenous Nations
NBAN	Northern Basin Aboriginal Nations
NSW	New South Wales
NTA	<i>Native Title Act 1993 (Cth)</i>
NWI	National Water Initiative
SA	South Australia
SDL	Sustainable Diversion Limit
UR	Unregulated [NSW water entitlement]
VWAP	Volume-weighted average price
WAE	Water access entitlement
WRP	Water Resource Plan

First Nations' Acknowledgement

We, the First Nations of the Murray-Darling Basin, represented by MLDRIN and NBAN, recognise and acknowledge the considerable work and determination of our people to pursue water justice in the Murray-Darling Basin over many generations. We have never ceded Country or waters. Our voices have never been heard or listened to. Dispossession of our cultural rights to water is ongoing and its consequences continue to be felt by our people, including disconnection from our waterways. Our people continue to suffer.

Our people face water access injustices across the Basin. This report measures the inequality of water holdings in a way that reveals the true extent of this injustice to policy makers and governments. The overall message of this report is that the current share of water held by First Nations and Traditional Owner organisations is inequitable, appalling, and unacceptable. This report makes recommendations for improving this unfair situation.

To describe the current situation, the authors had to rely on water management tools and the language used by the MDBA and other government water agencies. Water governance in the Murray-Darling Basin reflects ways of managing water that are harmful to our people. This approach stresses the economic role of water and while that is important, water plays other roles, such as sustaining Country, kin, family, and other relations.

While we recognise the value of the research in this report for our ongoing fight for water justice, we also make the following important statements to assert our cultural knowledge and beliefs relating to water and in doing so, protect our Nations' cultural values. These statements have been written by representatives from MLDRIN and NBAN and are designed to inform all readers:

Responsibility for water: Only those with authority recognised by their Nation have decision-making responsibilities for their traditional Country. We recognise Traditional Owner clans and family groups and their rights to protect their traditional livelihoods and people. These rights are the same as those arising from sacred authority. Only Traditional Owners of the local area have the cultural and sacred authority to speak for Country. Clarity about authority is essential to decision making, including in response to recommendations such as those in this report, and if achieved will result in community harmony.

Ownership: So that governments can measure inequality in water entitlements, the researchers had to use the same measures that governments use to manage water. Therefore, this report accounts for water ownership, including among First Nations and Traditional Owner organisations, from a non-Indigenous perspective. That is, it looks only at existing permits to use water (called "entitlements") that are issued and authorised under government frameworks. These water entitlements often have a financial value on the water market and are considered assets. We recognise, though, that our people maintain inherent rights to water, and that these rights stress obligation, ownership and care. We see our water ownership as a *responsibility* to manage water around our Country to maintain our social, cultural, spiritual, and economic wellbeing.

Presentation of surface water and groundwater: The report also describes water in ways that are not how water exists in the land. Australian governments manage and measure surface waters (e.g. rivers and creeks) and groundwater (e.g. aquifers) through different and separate entitlement frameworks. This disconnection is not how water is; all waters are inseparable. Our rivers, creeks, aquifers, water holes, springs, and lakes are all part of one cultural and physical landscape in which our Loes/laws are embedded. Water managers need to acknowledge, respect, recognise, and respond to our connections and responsibilities to manage Country.

Overall, the language in this report is technical in nature because it is intended to inform government agency water managers and decision makers. The language used in this report does not in any way discount the languages used by First Nations people. A First Nations summary of the report will soon be available for First Nations, and their water managers and decision makers.

Water entitlements do not yet reflect the findings of recent National Cultural Flows research. Australian water legislation recognises our rights, but how this is translated on the ground is still evolving.

Our Country, our waterways, and our people are sick. This is because of the state of our waterways and the lack of respect for our water rights. Although it does not make the connections to health or well-being, this report very clearly shows the inequity and disparity in water holdings within the Basin. This is a national disgrace. The Murray-Darling Basin provides \$24 billion to the country's economy every year in agriculture alone, yet our people remain without water and generally live in a state of disadvantage.

We recognise the efforts of Griffith University's Australian Rivers Institute and the MDBA to carry out this research and we recommend this report to you. We do not want this research to sit on a shelf and achieve nothing. There is an expectation that changes will happen from recognising the decades of First Nations' advocacy. MLDRIN and NBAN will use this report to pressure government to be accountable and to make the necessary changes to redress the inequities it reveals.

Executive summary & key findings

Background

1. The most recent Indigenous population statistics for State portions of the Murray-Darling Basin (MDB) cited in most publications use 2001 Census data, making these estimates now close to 20 years old.
2. Evidence from a number of sources shows that much has changed in the Basin over the past 20 years and that more precise data about the Indigenous population and Aboriginal water holdings is required to understand and respond to these changes.

Key findings: Indigenous population

3. In 2016, the Indigenous Estimated Resident Population (ERP) in the MDB was 120,487, representing 5.3% of the total MDB population (2,252,123 persons).
4. Over half (53.7%) of the MDB Indigenous population live within the Northern Basin (64,739 Indigenous persons). In this region, Indigenous peoples also constitute 10.5% of the total population. By contrast, 46.3% of the total MDB Indigenous population live in the Southern Basin (55,748 Indigenous persons). Here, Indigenous people constitute a 3.4% share of the total population.
5. The 2016 MDB Indigenous population constitutes a 15.1% share of the total national Indigenous population (798,333 Indigenous persons). By comparison, the total MDB population (2,252,123 persons) constitutes 9.0% of the total national population.
6. From 2001 to 2016, the Indigenous population in the MDB increased by an estimated 43%, or 2.8% per annum. This rate of growth is more than five times the non-Indigenous population rate, which was estimated to be 8.0%, or 0.5% per annum over the same period. The Indigenous share of the total MDB population has increased from 3.4% in 2001 (Taylor & Biddle, 2004) to 5.3% in 2016, and this share is likely to continue to grow into the future.
7. The largest proportion of the Basin's Indigenous population resides in New South Wales (NSW) (65.1%), where Indigenous peoples constitute a 9.3% share of the total population.
8. More than half (54.5%) of the MDB's Indigenous population live in four Sustainable Diversion Limit (SDL) resource units, three of which are located in NSW. The Macquarie-Castlereagh SDL resource unit had the largest Indigenous ERP in 2016, with 25,524 Indigenous persons representing 21.2% of all Indigenous persons in the MDB.
9. The three SDL resource units with the highest Indigenous population as a proportion of the total population were Intersecting Streams (27.7%), Warrego (19.4%), and Gwydir (16.2%).

Key findings: Aboriginal surface water holdings

10. Across the MDB, at least 30 Aboriginal entities hold at least 12.774 GL/y under 64 entitlements.
11. Aboriginal water holdings constitute a mere 0.17% of the relevant Basin States (excluding Victoria) or 0.12% of the equivalent take Baseline Diversion Limit (BDL) of the whole Basin (including Victoria).
12. The largest volume of water held by Aboriginal entities in the MDB is located in the NSW portion (93.9%). No Aboriginal water holdings were identified in Queensland or the Australian Capital Territory (ACT).
13. Indigenous peoples represent 6.5% of the total MDB population (excluding Victoria) but by comparison, Aboriginal entities hold a mere 0.17% of the available surface water in this area.

-
14. Aboriginal entities in the north of the Basin hold a smaller fraction of available water (0.11%, compared to 0.21% in the south).
 15. Across the Basin, historic land transfers facilitated by the Indigenous Land and Sea Corporation (ILSC) were found to be a key means by which Aboriginal entities acquired water rights (these were attached to land purchased by the ILSC).
 16. The land and water transfers to Aboriginal entities that occurred via measures under the *Aboriginal Land Rights Act 1983* (NSW) are unique to that State, and are likely to have contributed to the comparatively greater volume of water held by Aboriginal entities in this region. Aboriginal entities in NSW hold 11.992 GL/y, which equates to 0.21% of the NSW BDL.
 17. For the South Australian portion of the MDB, Indigenous persons make up a 3.3% share of the 2016 ERP, while Aboriginal entities hold 0.11% of all long-term diversion limit equivalence (LTDLE) water.
 18. In the Queensland portion of the MDB, Indigenous persons represent a 6.0% share of the total population, but Aboriginal entities hold no water use entitlements.
 19. In the ACT, Aboriginal entities hold no water use entitlements, despite an Indigenous population of almost 7,500, constituting a 1.9% share of the total ACT population.
 20. The LTDLE volume of Aboriginal-held water in the Victorian portion of the MDB could not be determined but, like other jurisdictions, it is expected to be extremely small.
 21. Ten of the 11 SDL resource units in which Aboriginal entities hold water are in NSW. The largest Aboriginal-held volume is within the NSW Murray SDL resource unit (4.225 GL/y), closely followed by the Murrumbidgee SDL resource unit (3.954 GL/y). These Aboriginal holdings constitute 0.25% and 0.19% of all water available in the respective SDL resource unit.
 22. The SDL Resources Unit where the portion of water held by Aboriginal organisations is largest is the Lower Darling (1.64% or 0.902 GL/y) and the smallest is the Gwydir (0.01% or 0.031 GL/y).
 23. Aboriginal entities hold, and therefore access, water through a combination of regulated (79%) and unregulated (20%) water entitlements across the Northern Basin (21%) and Southern Basin (79%).
 24. Aboriginal entities hold disproportionately more water under unregulated entitlements not only across the whole Basin, but also particularly in the Northern Basin. This can be a less reliable means of accessing water.
 25. The majority (87.3%) of LTDLE Aboriginal-held water under regulated entitlements is of lower security or reliability. In other words, only a small number of Aboriginal organisations benefit from comparatively greater reliability and certainty of water access; the vast majority receive little such benefit. Further, much of the water that can be accessed through the more reliable entitlements can only be used for domestic and stock purposes.
 26. Aboriginal-held water entitlements in SA are more reliable than most other Aboriginal-held entitlements in the Basin.
 27. Aboriginal water holdings in the MDB are valued at approximately \$18.4 million in 2015-16 water market terms. These holdings constitute just 0.11% of the MDB's \$16.5 billion water market (in 2015-16 terms). Aboriginal-held water entitlements in the Southern Basin are valued at approximately \$15.3 million. Aboriginal-held entitlements located in the Northern Basin are valued at approximately \$3.1 million. Across the Basin, Aboriginal-held unregulated water entitlements are valued at approximately \$1.8 million.

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28. The Australian Government's \$40 million commitment to purchase water for Aboriginal people for economic and cultural purposes equates to just 0.2% of the MDB's water market (in 2015-16 terms).

Key findings: Aboriginal groundwater holdings

29. A novel method was developed for comparing groundwater entitlements across groundwater SDL resource units. The methodology determining available surface water cannot be applied to groundwater.
30. Aboriginal organisations hold 0.556 GL of groundwater entitlements, which equates to 0.022% of the available groundwater resource across the whole Basin.
31. A total of six Aboriginal-held groundwater entitlements were identified, all of which are located within NSW.
32. Aboriginal-held groundwater entitlements are valued at approximately \$772,800 (in 2015-16 terms).

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1. Introduction and purpose

This report presents the findings of a data benchmarking exercise commissioned by the Murray-Darling Basin Authority (MDBA). The report intends to improve understanding of current Aboriginal surface water and groundwater access and basic demographic data across current water management units in the Murray-Darling Basin (MDB).

The MDBA commissioned this work following similar research that the lead author completed as part of her PhD at Griffith University (Hartwig, 2020). That work examined Aboriginal water entitlements for only the NSW portion of the MDB (see also Hartwig, Jackson & Osborne, 2020).

The specific tasks of this project were to:

- Update (2016) Aboriginal population statistics for all regions across the Basin, based on Surface Water Sustainable Diversion Limit (SDL) resource units;
- Establish a Basin-wide 2020 Aboriginal water holdings baseline/s that is compatible with Basin Plan water accounting methods;
- Where possible, document changes to Aboriginal water holdings over the last 10 years;
- Identify features of entitlement and licencing systems and recordkeeping that limit future monitoring of Aboriginal water holdings; and,
- Develop recommendations for the MDBA and the Basin States and Territories to improve monitoring of water access for Aboriginal peoples and inform future research.

The information contained in this report will be useful to policy-makers and officials from the MDBA, the Indigenous Land & Sea Corporation (ILSC), New South Wales Aboriginal Land Council (NSWALC), and various state and federal government agencies. It will also be of use to Basin Aboriginal peoples and their representative organisations, including (but not limited to) the Murray Lower Darling Rivers Indigenous Nations (MLDRIN) and Northern Basin Aboriginal Nations (NBAN). More specifically, these baselines will be of crucial importance to current government efforts to develop new policies and programs targeted at improving Aboriginal water access in line with national water policy; evaluate and monitor existing plans and programs (including the Basin Plan); and, assist First Nations people to contribute to water policy. It also complements the recent assessment of social and economic conditions in the MDB (Sefton et al., 2020).

Terminology, scope, and structure

In this report, we use “Aboriginal” or “First Nations” in preference to “Indigenous” when referring to the First Peoples of Australia’s mainland. We reserve the use of the term “Indigenous peoples/persons” for describing Census population and demographic statistical information, which combines those people who identify as of Aboriginal and/or Torres Strait Islander origin.

There are many ways that First Nations can access, use, benefit from and care for water (Jackson, 2017; Ribot & Peluso, 2003; Gimelli, Bos & Rogers, 2018). There are many different types of water rights such as, but not limited to, rights to access, withdraw, manage, and exclude others from water resources (Schlager & Ostrom, 1992) and these property systems rarely acknowledge the rights of Indigenous peoples (Jackson, 2018). Across the MDB, First Nations hold inherent rights to water—and Country more broadly. These rights are described in a National Cultural Flows Research Project report: “First Nations Peoples have rights and a moral obligation to care for water under their law and customs. These obligations connect across communities and language groups, extending to downstream communities, throughout catchments and over connected aquifer and groundwater systems” (MLDRIN, NBAN & NAILSMA, 2017, p. 3). First Nations aspire to have their sovereign claims

to water recognised and for appropriate forms of economic activity based on water utilisation (MLDRIN, 2010).

The scope of this report concerns the means by which First Nations access and benefit from water via state-issued, or statutory, water entitlements that grant holders permission to take, extract and use water from surface water sources (such as rivers and creeks) and groundwater sources (aquifers). The report does not consider statutory rights to access water that do not require an entitlement, including water use rights associated with land occupation like stock and domestic basic rights and native title rights to water, for example.¹ There have been several successful native title claims in the MDB that have included rights that are relevant to water (see Hartwig, Jackson & Osborne, 2018).

This report concerns both surface water and groundwater, but generally treats them separately. We acknowledge this separation runs counter to Aboriginal peoples' understandings and conceptions of water systems and Country (see MLDRIN, NBAN & NAILSMA, 2017; Moggridge, 2020). State water agencies treat surface water and groundwater entitlement systems separately, with separate water accounting methodologies for each (see, for example, MDBA, 2019f), and so we have followed that convention in order to enable comparisons and standardisation.

For several reasons, the report places greater emphasis on access to surface water over groundwater. First, previous baselining exercises (Altman & Arthur, 2009) showed that Aboriginal entities held few groundwater entitlements, and our research confirmed the low rate of access to groundwater. Second, there are far fewer groundwater entitlements on issue across the Basin. For example, in the 2018-19 water year, 88% of water entitlements by volume across the Basin related to surface water sources, with the remaining 12% to groundwater sources (BOM, 2020).

The diverse ways in which Aboriginal entities use or aspire to use, manage, or benefit from their water entitlements is beyond the scope of this report but is nonetheless an important topic of future research. We note that following the principle of the right to self-determination enshrined in international law (Robison et al. 2018) and the Australian cultural flows concept (see Section 2), water use is a matter for First Nations to decide. Water use may include temporary trade of water, which has the potential to generate income for Aboriginal organisations that can then be used for an array of social, community or economic outcomes, as determined by that organisation and community (see Hartwig, 2020).

This report is structured as follows. First, we briefly detail the historical, legislative and policy context of Aboriginal water rights in the MDB, as well as the growing calls for water redistribution to First Nations from not only First Nations and researchers, but also governments and industry bodies. As part of this background and context, we also draw attention to the dearth of current information about Aboriginal socioeconomic and demographic conditions, and Aboriginal water access in the Basin. We consider the implications for developing evidence-based policy and programs to improve First Nations' water access. Together, this information points to the need for current Aboriginal population and water-holding baselines. After outlining the methods used to develop these baselines, we then present key findings, then discuss the findings in the context of research, policy development and other ongoing water reviews. We conclude with recommendations for policy and future research.

¹ See Appendix G for a brief list of alternative water access options.

The key baselines developed as part of this work are presented in the first three appendices to this report. Appendix A lists the 2016 population baseline, Appendix B lists the 2020 Aboriginal surface water holdings baseline, and Appendix C lists the 2020 Aboriginal groundwater holdings baseline.

2. Background

First Nations peoples have relied on waters and waterways for their survival in Australia for tens of thousands of years, including in the MDB. The Basin overlaps with over 40 First Nations' customary territories. For many Nations, water and waterways are central to livelihoods, socio-cultural practices, and identities. The Barkandji People's name, for example, literally means people belonging to the river *Barka* (the Darling River). Interconnected land and water systems (both surface waters and groundwaters) are vested with religious and cultural significance (Moggridge, 2020; Morgan, 2011; Robison et al., 2018; Weir, 2009). Figure 1 illustrates the relationship of First Nations' territories to surface water management units across the Basin (called Water Resource Plan areas, described further below).²

Throughout the history of the MDB and the development of its water resources First Nations peoples were excluded from the institutions that governed water use and management. Godden, Jackson & O'Bryan (2020) argue that water laws (and land laws where they governed rights to water) were pivotal to the dispossession of First Nations. Aboriginal peoples were denied riparian rights and access to statutory water entitlements under colonial, then state, laws (Berry & Jackson, 2018). Governments ignored Aboriginal peoples when making decisions about water (e.g. in the early inter-governmental agreements relating to the River Murray) and when building the water-based economy, including the regulatory regime that gave rise to the water market (Downey & Clune, 2020; McAvoy, 2006, 2008). Aboriginal water rights in Australia are now receiving greater research and policy attention. However, as the following description indicates, Australian water laws and policies have not yet adequately addressed Indigenous water rights and claims (Jackson, 2017; Tran, 2009), especially the redistribution of rights to use water for commercial purposes. Indeed, many see this neglect as the "unfinished business" of Australia's water policy (Jackson, 2017, p. 122; MLDRIN, NBAN & NAILSMA, 2017, p. 4; Productivity Commission, 2017, p. 11).

²² An equivalent groundwater map is provided later, on page 13.

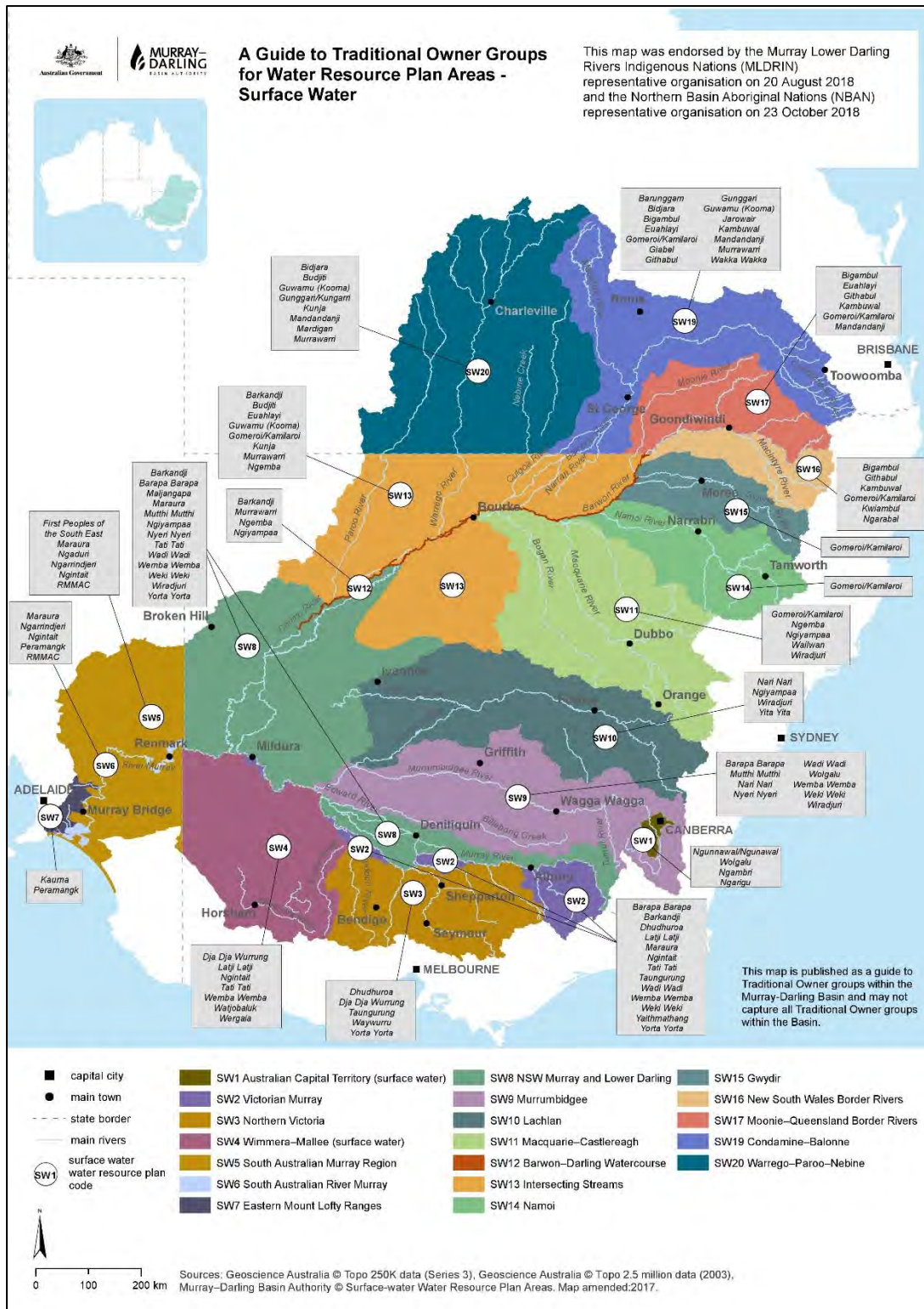


Figure 1: A guide to Traditional Owner Groups for Surface Water, Water Resource Plan areas in the Basin
 Copyright: MDBA (2018a), A Guide to Traditional Owner Groups for Water Resource Plan Areas: Combined Maps, Canberra. CC BY 4.0.

Legislative and policy context: First Nations' water rights in the Murray-Darling Basin

The first national act of recognition of the distinct water rights, interests and values of Aboriginal peoples was the passage of the *Native Title Act 1993* (Cth) (*NTA* hereafter). The *NTA* (section 223) defines native title as the communal, group or individual rights and interests of Aboriginal or Torres

Strait Islander peoples in relation to land *and* waters. O'Donnell (2013) argues that there are two propositions that are clear in relation to native title rights to water in Australia. The first is that native title does not include ownership of natural waters. That is on the assumption that the common law position is that water in its natural state is not amenable to ownership. The second proposition is that where native title can be proven to exist, it generally includes rights to take and use water for personal, social, domestic, and cultural purposes, but not commercial uses. It can include:

- a right to teach the physical and spiritual attributes of places and areas of importance on or in the land and waters;
- the right to have access to, maintain and protect places and areas of importance on or in the land and waters; and
- a right of access to take water for those purposes.

Under the *NTA*, rights to hunt, gather and fish for the purposes of satisfying the personal, domestic, or non-commercial needs of native title holders can be exercised free from licensing or permit restrictions that otherwise apply to such activities. The same exemption applies to cultural and spiritual activity and other kinds of activity that may be later prescribed, provided the activity involves the exercise or enjoyment of native title rights and interests. A native title right to take and use water for commercial purposes has not (yet) been recognised (O'Donnell, 2013).³ There is however, increasing recognition that Indigenous rights to water should include commercial rights (Godden et al. 2020). Indigenous advocacy has promoted this viewpoint and it has gained some limited traction, influencing national water policy towards recognition of resource rights.

The *NTA* provides that a State/Territory Parliament may make and amend water management legislation and issue entitlements or permits to take and use water and validly affect the native title right to water (O'Donnell, 2013). A right to compensation and the "principle" of the non-extinguishment of native title applies in such circumstances. A procedural right of notification and an opportunity to comment applies prior to the grant of any licence to take water.

Establishing native title has become difficult as amendments to the *NTA* and decisions of Australian courts have adopted an overly specific and restrictive approach to Indigenous rights. In relation to water, a number of scholars further argue that Australian water managers take a narrow view of their obligation to protect native title from impairment by over-allocation upstream or general encroachment (Behrendt & Thompson, 2004; McAvoy, 2006; 2008; Tan & Jackson, 2013).

The emergence of the native title framework in the 1990s coincided with the first tranche of water reforms, including the separation of land and water titles and the creation of a water market. These early reforms did not account for Aboriginal rights and interests in water.

Some Australian States and Territories amended their water laws to recognise the existence of native title (e.g. NSW). Some initiatives apply to the water planning context, such as Indigenous-specific water entitlements in NSW. These are a subcategory of mainstream water entitlement specifically for Aboriginal peoples' use or benefit. However, as addressed elsewhere, these entitlements have had little take up due to their restrictive conditions, low community awareness or interest, costs required to access, use or store the water, and obstacles to application (Hartwig, 2020; Jackson & Langton, 2012; Sefton et al., 2020; Tan & Jackson, 2013).

³ While the possibility for economic uses and benefits of native title rights to natural resources, including water, has emerged in recent years, including as a recommended area for legislative reform (Australian Law Reform Commission, 2015), this has not yet eventuated.

More than a decade after the introduction of the *NTA*, in 2004 Australian governments agreed to the National Water Initiative (NWI). This national blueprint for water reform set expectations for state and territory water access and planning frameworks. The NWI recognised Indigenous water rights and interests (Jackson & Morrison, 2007), although Indigenous people were not involved in shaping this important policy (Jackson, 2017). The NWI establishes a “Water Access Entitlements and Planning Framework” that lists Indigenous needs in relation to water access and management as an outcome (see NWI 2004, cl 25). The Parties to the NWI are to provide for Indigenous access to water resources by:

- including Indigenous representation in water planning, wherever possible; and,
- incorporating Indigenous social, spiritual, and customary objectives and strategies for achieving these objectives, wherever they can be developed.

Water planning processes are also expected to take account of the possible existence of native title rights to water in surface water or groundwater areas by:

- potentially allocating water to native title holders; and,
- accounting for any water allocated to native title holders for traditional cultural purposes (NWI 2004, clauses 52-54).

The NWI and these principles, however, have been criticised for their weak and discretionary nature (Jackson & Morrison, 2007; Marshall, 2017). No penalties are imposed on State and Territory governments for poor or non-compliance and therefore, there is little incentive to drive change that meaningfully recognises and accommodates Aboriginal water rights (Marshall, 2017; Tan & Jackson, 2013). Reviews by government agencies have consistently identified these weaknesses (NWC, 2009, 2011, 2014; Tan & Jackson, 2013). More recently, the Productivity Commission (2020) has been tasked with reviewing the NWI and the Commonwealth Government has identified the need to improve Indigenous access under a revised NWI.

Soon after the NWI was agreed, and at the peak of Millennium Drought, the *Water Act 2007* (Cth) was passed. It implemented reforms as directed by the NWI, such as legislating the Australian Government’s roles in water governance and dictated the development of the Murray Darling Basin Plan (Ridge, 2016). The Australian Government pledged approximately A\$13 billion to develop and implement instruments to recover 2,750 GL/y (long-term average annual yield) of water for environmental purposes via entitlement buy backs through the water market and improvements to water infrastructure efficiency (Grafton & Wheeler, 2018). Amendments to the Basin Plan since 2012 have reduced this long-term average recovery volume. At present, the Basin Plan aims to recover 2,075 GL/y of water plus 450 GL/y through efficiency measures and rule changes through the SDL Adjustment Mechanism by 2024 (see MDBA, 2020c).

The *Water Act 2007* (Cth) contains various process and consultation requirements relating to First Nations⁴ allowing for participation and representation in several specific ways.⁵ The Basin Plan

⁴ The *Water Act 2007* stipulates that the MDBA’s functions include engaging “the Indigenous community on the use and management of Basin water resource” (section 172(1)(ia)) and developing a Basin Plan that has regard for Indigenous issues (section 21(4)(v)). It stipulates the Basin Plan must, as “mandatory content”, include a description of all water resource uses in the Basin including by Indigenous peoples (section 22(1)). It also instructs that WRPs have regard to “social, spiritual and cultural matters relevant to Indigenous people in relation to the water resources of the water resource plan area in the preparation of the water resource plan” (section 22(3)(ca)). The *Water Act 2007* specifies that restrictions on water use or extraction from water trading can only arise to manage certain issues one of which is features of major Indigenous, cultural heritage or spiritual significance (schedule 3).

⁵ For example, the *Water Act 2007* reserves two positions on the Basin Community Committee for “Indigenous persons with expertise in Indigenous matters relevant to the Basin’s water resources” (section 202(5)) and the development of an Indigenous water subcommittee “to guide the consideration of Indigenous matters relevant to the Basin’s water resources” (section 202(3)). From the Basin Plan, the

includes processes to address Indigenous peoples' water interests. Specifically, Chapter 10, Part 14 of the Basin Plan stipulates how Basin States and Territories are to have regard to Indigenous values and uses in the development of Water Resource Plans (WRPs). In preparing WRPs, States are also required to have regard for native title rights, native title claims and Indigenous Land Use Agreements (Godden et al. 2020). The Basin Plan is specifically required to provide information about Indigenous uses of Basin water resources (see Section 22 (1)). In 2019, an amendment to the *Water Act 2007* (Cth) passed to enable the appointment of an Aboriginal representative to the MDB Authority, but at the time of writing, no appointment had been made more than 12 months later (Foley, 2020).

Established under the *Water Act 2007* (Cth), the MDBA has developed and deployed a number of Basin-wide policy and program partnerships and activities aimed at improving, empowering, and recognising Aboriginal water interests (see Jackson, Woods & Hooper, 2021; MDBA, 2017a). These measures to advance First Nations rights and interests still fall short of requirements under international instruments such as the UNDRIP (Godden et al., 2020). Many have criticised the *Water Act 2007* (Cth) for these reasons.

In summary, Aboriginal people have entered the current era with very limited water holdings. This is because of several overlapping factors. First, initial British occupation dispossessed most Aboriginal peoples of their land, and the water rights attached to land. Then, land restitution processes introduced from the 1970s onwards, limited the amount of irrigable land (land with water entitlements attached) available for Aboriginal people to claim (Hartwig et al., 2020). Around the time that these restrictive land restitution processes were introduced and native title rights (rights to land and water) were recognised by the common law, the legal frameworks regulating water were restructured. Changes included the separation of land and water titles and the establishment of water markets. At this critical juncture in water governance reform, governments exacerbated the inequitable pattern of water rights distribution that they had inherited from the colonial era by grandfathering water rights to then existing rights-holders (Hartwig et al., 2020). At the same time, key water resources in the Basin were "closed" to establish water markets and restore waterways.

Moreover, native title and specific purpose licence mechanisms have so far offered no meaningful means of redistributing water use rights. The constellation of these circumstances has strongly shaped current patterns of non-Aboriginal and Aboriginal water access such that in the majority of surface water systems across the MDB, there is no unallocated water for Aboriginal people to apply for, as others have done for generations. Instead, the water market is now the only option for Aboriginal people to secure water entitlements that are equivalent to those held by other water users (Jackson, Hatton MacDonald & Bark, 2019; Productivity Commission, 2017).

First Nation, government and industry calls to redistribute water to First Nations

First Nations developed the concept of "cultural flows" (MLDRIN, 2010; Weir, 2009) as a response to dispossession and exclusion from water governance. The concept emphasises Aboriginal control and self-determination in the outcomes to be achieved from using water (Mooney & Cullen, 2019; Morgan, 2011; Weir, 2009), and it has gained some traction in Australian water management circles.

In 2007, First Nations developed a formal definition for cultural flows in the Echuca Declaration:

"Cultural Flows" are water entitlements that are legally and beneficially owned by the Indigenous Nations of a sufficient and adequate quantity and quality to improve the

MDBA is required to "have regard" for Indigenous values and uses in developing the Basin-wide environmental watering strategy (clause 8.15(4)) and annual environmental watering priorities (clause 8.29(3)).

spiritual, cultural, environmental, social and economic conditions of those Indigenous Nations. This is our inherent right. (MLDRIN, 2010)

The MDBA has committed to supporting the establishment of dedicated cultural flows, recognising that “dedicated cultural flows are not currently part of the water management system in Australia” (MDBA, 2019a). It supported the seven-year National Cultural Flows Research Project that commenced prior to the Basin Plan.⁶

The National Cultural Flows Research Project produced a series of reports that have advanced understanding of cultural flows (<https://culturalflows.com.au/>). A key component of the project involved developing a methodology for determining and quantifying the flow regimes needed to achieve cultural flow objectives and outcomes. The research included testing this method at two case study locations in NSW, and documenting the associated spiritual, cultural, environmental, social, and economic benefits (MLDRIN, NBAN & NAILSMA, 2017). A key recommendation from the project was that “First Nations require the permanent and ongoing ownership of water for cultural flow purposes that has the same status as commercial water rights, and with the flexibility to ensure the long-term development of sustainable enterprises” (MLDRIN, NBAN & NAILSMA, 2017, p. 20).

Consistent with this recommendation, recent reviews and submissions from government entities and irrigation bodies (see National Irrigators' Council, 2017) indicate acceptance of, and indeed support, the need for water rights to be redistributed to First Nations in the Basin (and Australia more broadly). For example:

- The Productivity Commission (2017) recommended that “where access to water is regarded as the best way to support Indigenous economic development objectives, governments should facilitate access to that water as efficiently and transparently as possible within existing entitlement frameworks” (p. 108). An upcoming review by the Productivity Commission will investigate this matter further (see Productivity Commission, 2020).
- The Northern Basin Commissioner identified that Aboriginal water access and redistribution requires greater attention from governments. He noted that “Aboriginal entitlement to water is unresolved compared with Aboriginal title in land” (Keelty, 2019, p. 33).
- The Independent Panel for the Assessment of Social and Economic Conditions in the MDB (Sefton et al., 2020) includes a number of recommendations in their recently published report that stress the need for governments to improve First Nations communities’ access to water for cultural and economic purposes, including support for Aboriginal enterprise development.

Recent research indicates public support for redistribution to Aboriginal peoples via existing market mechanisms (Jackson et al., 2019).

At both the Federal and State government levels, a number of policies and programs targeted at improving Aboriginal water access are under development (see, for example, DAWR, 2018; DNRME, 2019; see also Appendix G). To develop these programs and policies, as well as monitor and evaluate any that are established, governments, agencies and Aboriginal advocates require accurate data on current Aboriginal socioeconomic demographics (Taylor & Biddle, 2004) and their water-related experiences. However, this information is not readily available (Marsden Jacobs, 2019; Nikolakis & Grafton, 2015; Nikolakis, Grafton & To, 2013). Most recent research and analysis about Indigenous population and Aboriginal water holdings within and across the MDB is now dated and/or is incomplete, as we detail below.

⁶ Of note, State and Territory developed WRPs “must be prepared having regard to the views of Indigenous people with respect to cultural flows” (Basin Plan cl 10.54).

Most recent Indigenous population and water holdings baselines

Indigenous peoples of the Basin have a distinctly different socio-economic status and demographic composition to the non-Indigenous population, including lower rates of employment and lower household incomes. The Indigenous population is also relatively younger and rapidly increasing in comparison to the non-Indigenous population (ABS, ABARE & BRS, 2009; Taylor & Biddle, 2004).

The most recent population statistics for State portions of the MDB cited in most publications were provided by Taylor and Biddle (2004) using 2001 Census data, making these estimates now close to 20 years old. In 2009, the ABS et al. estimated Aboriginal population statistics from 2006 Census data, but these were reported for Sustainable Yield Regions. The CSIRO originally developed this geography to assess water availability (see CSIRO, 2018) but it was used in a number of other studies, including ABS et al. (2009). The reporting associated with the Basin Plan, however, now uses different areas or geographies called SDL resource units or Water Resource Plan (WRP) areas.⁷ In other words, the ABS et al.'s (2009) population estimates do not align with current mapping and reporting conventions, making comparisons over time difficult. Most recently, the Wentworth Group of Concerned Scientists (2017) provided an Aboriginal population estimate using 2016 Census data, but only at the Basin-wide scale.

Clearly, there is a pressing need for up-to-date Aboriginal population statistics at smaller scales in the Basin, especially when evidence indicates that Aboriginal populations have grown considerably in the MDB since 2001 (ABS et al., 2009; Wentworth Group of Concerned Scientists, 2017). Conversations with MLDRIN leadership as far back as March 2016⁸ indicate community demand for this kind of information. The recent independent assessment of social and economic conditions in the Basin has confirmed the need for this data (see Sefton et al., 2020).

Available information about Aboriginal water holdings is also severely limited and dated. In 2009, Altman and Arthur completed a scoping exercise that documented “for the first time actual allocations of water licences and entitlements to identified Indigenous users” across Australia (p. i). This work set an important benchmark and illuminated numerous gaps in knowledge and in institutional and governance arrangements. Arthur (2010) completed a similar exercise soon after focusing on the MDB. However, for several reasons there is a need to develop a more detailed and refined Aboriginal water holdings baseline.

First, in Altman and Arthur's (2009) work, Aboriginal-held entitlements are reported at the level of each State and Territory, but they do not identify those that are within the Basin. Although a later study by Arthur (2010) focuses explicitly on the MDB, only aggregate volumes of Aboriginal-held water entitlements are presented (not individual entitlements as Altman and Arthur (2009) present), and for the Sustainable Yield Regions that are no longer used by water regulators.

Second, Federal and State water policy and legislation have altered since 2009, sometimes quite significantly, and this has seen the character of some entitlements change, including those held by Aboriginal entities. Third, recent research by Hartwig (2020; see also Hartwig, et al., 2020) indicates that there have been significant changes (declines) to Aboriginal water holdings in NSW since Altman and Arthur's 2009 baseline. Hartwig et al. (2020) found that Aboriginal surface water holdings have decreased by almost 20% across the past decade (from 2009 to 2018) in the NSW portion of the MDB. The results revealed that Aboriginal people now represent nearly 10% of the NSW MDB

⁷ This impact of different geographies in the context of this report's methods is considered further in Section 3.

⁸ In March 2016, Lana Hartwig attended a MLDRIN Board meeting in Mansfield, Victoria, seeking advice about what research outputs MLDRIN would find useful in its operations.

population but hold only 0.2% of the available surface water. In analysing these results, the authors came to appreciate the urgent need for a wider MDB analysis of Aboriginal water holdings beyond NSW.

It is clear to the MDBA that updated baselines for these two features—population and water holdings—together with other research currently underway, will serve not only as useful inputs for the development of the aforementioned Aboriginal water access programs, but also as important benchmarks for the 2020 Basin Plan evaluation and others. Moreover, baselines like these can help to generate “essential input to the identification of priority regional development issues and [assist] in the building of capacity for Indigenous nations’ governance by enhancing the flow of information and degree of local knowledge of social and economic circumstances” (Taylor & Biddle, 2004, p. 1).

Water policy and management terminology used in this report

To round out this background section, we briefly explain the terminology we use in this report. We explain some key differences between surface water and groundwater in terms of government water policy and management, water entitlement features, and how entitlement holders use and extract water from surface sources and groundwater sources.

As noted, the Basin Plan exists alongside, and is intended to complement, State, Territory and other Federal water and natural resource management frameworks and policies. In this way, Basin State and Territory governments and the Australian Government share responsibilities for developing, amending, implementing, and monitoring the compliance of water laws and rules.

The Basin Plan 2012 set limits on how much water can be taken from surface and groundwater resources across the Basin. These limits are called *Sustainable Diversion Limits* (SDLs) and consider the water used by towns, communities, irrigators, farmers and other water extractions (i.e. not the environment). These limits were set for specific water management areas across the Basin, called *SDL resource units*. *Baseline Diversion Limits* (BDLs) were also determined for each SDL resource unit area, which approximate the scale of water diversions prior to the Basin Plan commencing.

Defined areas of water management in the MDB build on each other like a scaffold. SDL resource unit areas are the smallest. One or more SDL resource unit area combines to make up Water Resource Plan (WRP) areas, the next largest water management area. Under the Basin Plan, State and Territory governments are tasked with developing WRPs that set the rules for sustainable management of water resources in each defined WRP area.

Surface water

Looking at surface water only, across the MDB there are 29 defined SDL resources units contained within 19 WRP areas, with the latter depicted earlier in Figure 1. These surface water management units are based on topographical and landscape formations. It is worth pointing out that the Barwon-Darling Watercourse SDL resource unit and WRP area are unique in that they only include the watercourse i.e. the river channel (see Figure 1 earlier, for WRP area). All other surface water management units include watercourses and at least some adjacent land area that drains to the watercourse.

For the purpose of managing surface water, the MDB is separated into the *Northern Basin* and the *Southern Basin* (see Wheeler & Garrick, 2020; Figure 2).⁹ This divide is also used to determine Nation

⁹ All references to Northern Basin and Southern Basin in this report are taken to be surface water units.

membership in NBAN and MLDRIN (respectively). We note that that First Nations' territories do not align with these water management units.

For surface water, SDLs are generally lower than BDLs. At a Basin scale, this necessitated a reduction in the average annual level of surface water extractions by about 25% (Grafton, 2019). Work has been underway to reduce water extractions to the new lower levels by recovering water for the environment. Australian governments have been bridging this gap primarily through water buybacks and efficiency upgrades to water infrastructure (Grafton & Wheeler, 2018). We note that a recent policy change has ruled out further buybacks for water recovery (DAWR, 2020), and some are concerned about the implications for reaching SDLs on time (Davies, 2020).



Figure 2: The boundary of the Murray–Darling Basin, including the boundaries of the Northern and Southern Basins
 Copyright: MDBA (2018b), The boundary of the Murray–Darling Basin, including the boundaries of the northern and southern basins, Canberra. CC BY 4.0.

Groundwater

For groundwater sources, there are 80 defined SDL resource units grouped into 19 WRP areas. Figure 3 shows how First Nations' territories overlap with Basin groundwater WRP areas and that groundwater WRP areas (and also SDL resource units) sometimes overlap. This is because

groundwater management units are defined based on hydrogeological formations, rather than topographical and drainage features. This means that groundwater SDL resource units and WRP areas can be vertically stacked. Individual groundwater sources also have varying hydrological connections dependent on their geological layers. Surface water and groundwater sources can be hydrologically interconnected, and so the management of water resources in a given area requires a consideration of both surface water and groundwater, as well as the nature of their connectivity.

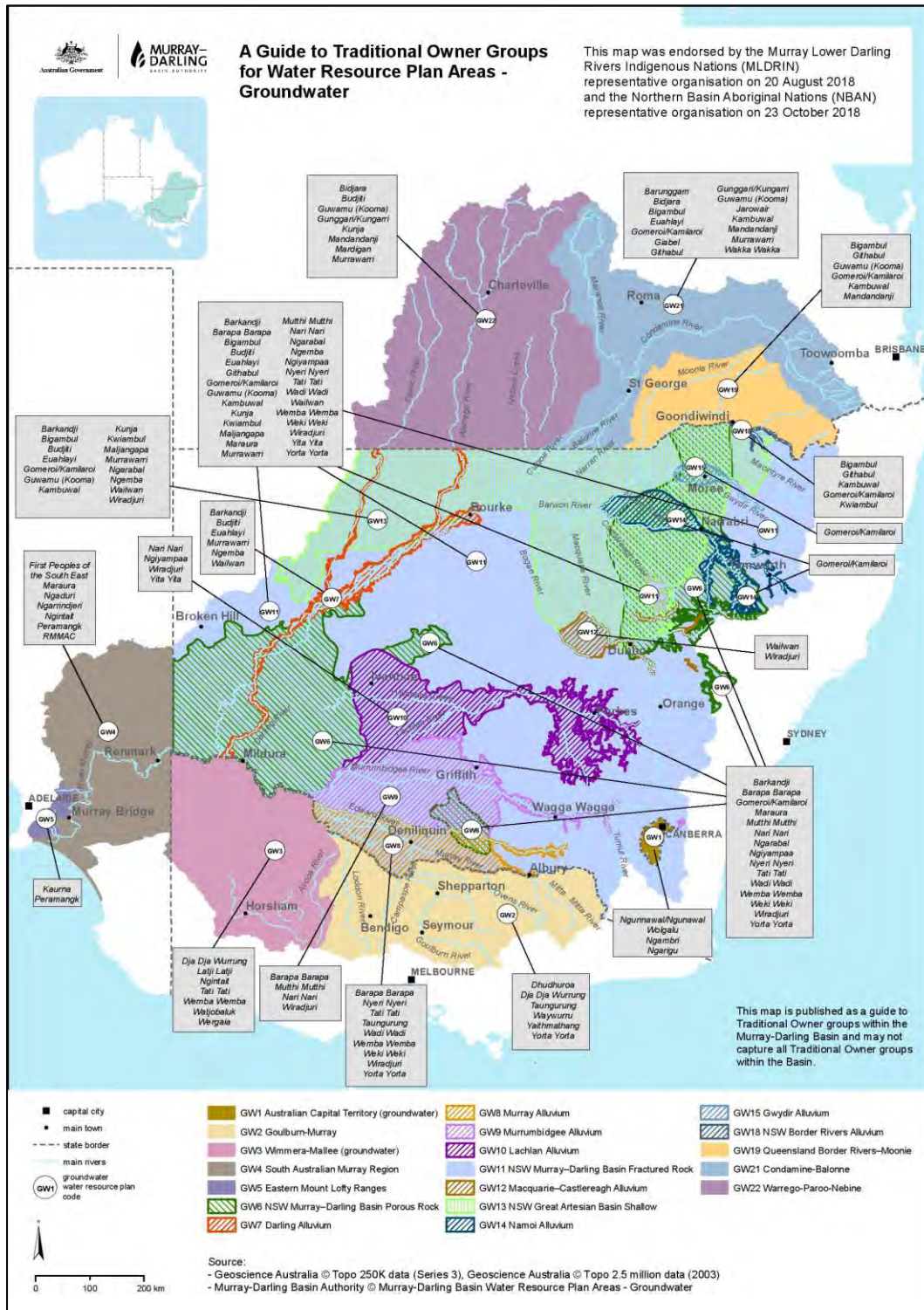


Figure 3: A guide to Traditional Owner Groups for Groundwater Water Resource Plan areas in the Basin
 Copyright: MDBA (2018a), A Guide to Traditional Owner Groups for Water Resource Plan Areas: Combined Maps, Canberra. CC BY 4.0.

In contrast to surface water, most groundwater SDLs are equal to or greater than the BDL, meaning that there is often potential for groundwater take to increase in the future within the settings of the Basin Plan.¹⁰ Indeed, following amendments in 2018, the Basin Plan now sets a Basin-wide groundwater SDL that is 40% greater than the Basin-wide BDL (Grafton, 2019).

Water use entitlements

State and Territory governments distribute licences or entitlements to access and use water in the MDB (and indeed, across Australia). Figure 4 below shows the difference between water entitlements and water allocations. Water entitlements are rights to an ongoing share of available water, also called a water licence in some jurisdictions. For ease of explanation, a water entitlement can be represented as an empty, fixed-volume bucket (Figure 4). Water allocations are the amount of water that a water entitlement holder can actually use. The relevant State or Territory authority distributes them to water entitlements seasonally. In other words, allocations are the amount of actual water available in the fixed-volume bucket entitlement. Allocation volumes change from year to year, based on storage conditions, expected weather patterns, entitlement type, and legislated triggers. Allocations are usually announced as a proportion of the entitlement volume.

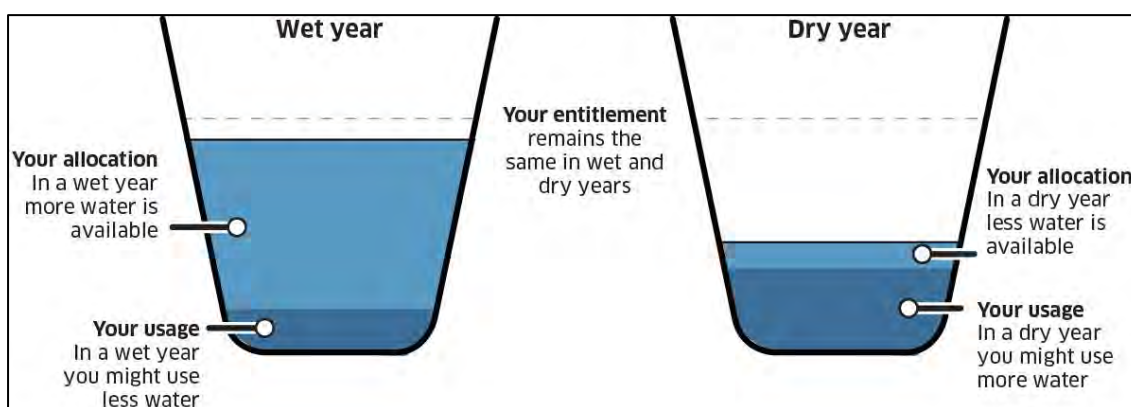


Figure 4: Variable water allocations versus constant entitlements across wet and dry years
Copyright: MDBA (2019b), *Factors for water recovery*, Canberra. CC BY 4.0.

There are different types of water entitlements, but some are prioritised to receive allocations first. Entitlements with lower reliability receive lower—sometimes no—allocations in drier years (seen on the right in Figure 4). *Reliability* is “the likelihood of an amount of water being allocated to a particular class of entitlements” (MDBA, 2019b) over the water year, which runs from July to June.

Among surface water entitlements, Domestic and Stock entitlements are prioritised in legislation as the most reliable. Water entitlements exist in both *regulated* systems (where flows are controlled through infrastructure (such as dams and weirs that store and release water) and *unregulated* systems (where water use is far less controlled by infrastructure). Regulated water entitlements have different levels of reliability while entitlements in unregulated systems generally have no formal reliability (Wheeler et al., 2014a). Overall, the Northern Basin is more unregulated and hydrologically disconnected,¹¹ while the Southern Basin is more regulated and hydrologically interconnected.

Concerning groundwater, State water management plans generally allow 100% allocation of groundwater entitlements, unless they announce a lower percentage. In the 2017-18 water year,

¹⁰ The exception here is two groundwater SDL resource units in Queensland’s Condamine-Balonne WRP area where the SDLs are lower, requiring water recovery (MDBA, 2020b).

¹¹ ‘Disconnected’ means that that the flows and systems can be disconnected throughout the year, or over time.

only NSW, Queensland and Victoria announced allocations of less than 100% in specific groundwater SDL resource units or sub-areas (MDBA, 2019f). Reduced allocations may be announced when groundwater falls below particular legislated thresholds intended to protect the productive base of the aquifer.¹² While these entitlements receive high allocations and might appear nominally more reliable or secure, the quality (salinity) of and ease of access to groundwater resources varies across groundwater resources (MDBA, 2016). These and other factors mean that the actual volume of groundwater take in any given year is often less, sometimes significantly so, than the total volume available under groundwater entitlements.

¹² Such thresholds are important, for instance, for preventing localised drawdown which may limit access to neighbouring bores, land subsidence, or mobilisation of salinity or other water contaminants. In NSW, for example, if the long-term average annual extraction limit compliance test (established in Water Sharing Plans) is exceeded, the Minister may make an announced water determination (AWD) of less than 100% for aquifer entitlements in the next water year. In the 2019-20 water year, NSW made AWDs in several groundwater sources to reduce extractions after increased take and limited rainfall recharge through the recent drought (see NSW DPIE, 2019).

3. Methods

Indigenous population baseline (2016)

Population statistics presented in this report are from custom calculations of Indigenous and non-Indigenous Estimated Residential Populations (ERP) by Dr Francis Markham. These calculations relied on the 2016 Census (ABS, 2017, 2018b) and MDBA geographical units (2019e). For the purposes of consistency with the geographical units used by the MDBA, we chose surface water management units as the units for measuring and analysing population data. Further detail on the method and approach used to develop these estimates is presented in Appendix D.

Using Census data for Aboriginal population statistics has limitations (see Morphy, 2010; Taylor, 2011; Taylor & Biddle, 2010). For instance, at a conceptual level, Census and other government administrative counts presume of “a degree of homogeneity and sense of collective identity that simply does not match Indigenous peoples’ actual sociality and spatiality” (Taylor, 2011, p. 287). These administrative counts have little regard for the complexity of First Nations peoples’ social and economic relations (Morphy, 2010; Taylor, 2011).

Additionally, Census instruments substantially undercount Indigenous peoples (ABS, 2018a; Taylor, 2011; Taylor & Biddle, 2010). The 2016 Census, for example, did not count around 17.5% of Indigenous people in Australia (ABS, 2018a; see Appendix D). The reliance by government agencies on “official” counts that do not accommodate this undercounting have led to inadequate service delivery (Morphy, 2010; Taylor & Biddle, 2010). The ABS has developed strategies to adjust for undercounting, including produced ERP figures (Markham & Biddle, 2018). Another issue can also arise where Indigenous persons counted on Census night are “higher (often much higher) than expected on the basis of previous census levels and after accounting for intercensal change in basic demography—births, deaths and migration” (Taylor & Biddle, 2010, p. 470).¹³ This issue was more common than undercounting in much of the MDB based on 2006 Census analysis (Taylor & Biddle, 2010) and 2016 Census analysis (Markham & Biddle, 2018).

Notwithstanding the above, the best available information about Indigenous populations across Australia comes from Census counts and surveys (Markham & Biddle, 2018). Indigenous population statistics can still be useful for developing policy, and monitoring and evaluating its effectiveness into the future (Taylor, 2011; Taylor & Biddle, 2004). To improve accuracy and reliability in this report, we report ERP figures to account for possible undercounting and acknowledge that these figures are likely minimal estimates. We also generally report population estimates for larger regions (rather than small-scale estimates for remote localities where undercounts can be worse (see Taylor & Biddle, 2010)).

Aboriginal water entitlement baseline (2020)

As noted, the MDBA commissioned this work following research that Lana Hartwig completed as part of her PhD at Griffith University. With assistance from the MDBA’s Marcus Finn (Senior Director of Water Resource Plans and Basin Policy) and Tony McLeod (General Manager of SDL Accounting and Aboriginal Partnerships Branch), Hartwig (2020) developed a method to standardise Aboriginal surface water holdings in NSW that is compatible with current Basin Plan accounting methods. The method outlined here is similar and includes two steps: (1) identifying and (2) “standardising” Aboriginal held water entitlements for comparison. Due to significant differences between surface

¹³ Markham and Biddle (2018) describe factors contributing to this intercensal change, including changes in the ways that respondents identifying themselves as being of Aboriginal and/or Torres Strait Islander in Census surveys, identification of children from mixed Indigenous-non-Indigenous partnerships identifying as Indigenous and improving Census methodologies.

water and groundwater management, different “standardising” methods are required for the two, as detailed below.

The 2020 Aboriginal water holdings baseline produced through this method is contained in a separate confidential database, in accordance with privacy requests from some Aboriginal water holders interviewed as part of Hartwig’s PhD research, as well as some State and Territory agency staff that assisted in compiling this 2020 baseline. This baseline presents a snapshot in time of Aboriginal water holdings, the number of which are always changing (c.f. Altman & Markham, 2015).

The scope of this baseline exercise concerns entitlements held by Aboriginal organisations and entities only, not individuals. This is because the search functions of water registers do not identify individual Aboriginal people who might hold water entitlements (explained further below). We have taken the broadest understanding of Aboriginal organisations including Land Councils, Traditional Owner groups, Native title claimant or prescribed body corporate groups, Aboriginal Corporations, Associations, Housing Co-ops, or any other Aboriginal owned organisation or entity, where there is a majority of Aboriginal participation on the governance structure.

Identifying Aboriginal held water entitlements

Figure 5 presents the overarching approach we used to identify and confirm which Aboriginal organisations hold water in the MDB. The only known publicly available data regarding existing water licences held by Aboriginal peoples was generated by Altman and Arthur in 2009. We used this as a starting baseline and took direction from their methodology.

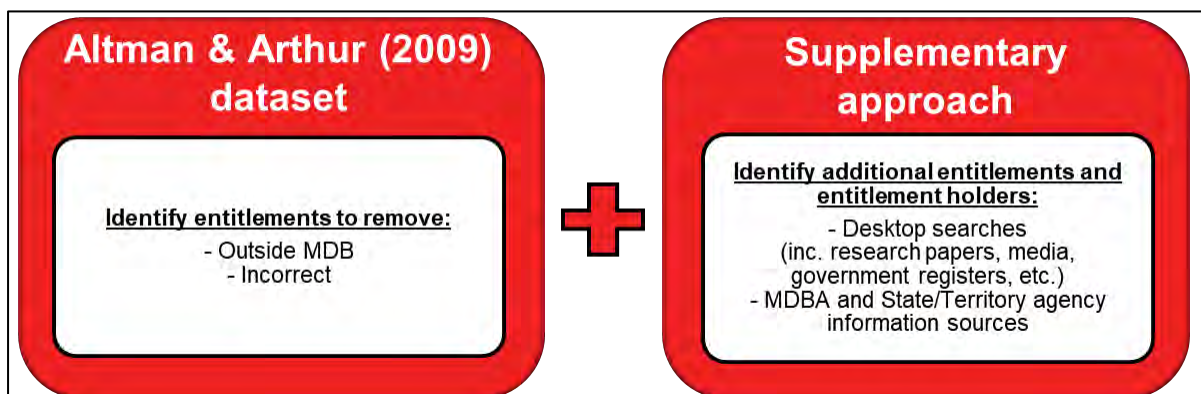


Figure 5: Methods for identifying actual and possible water holding Aboriginal organisations

Altman and Arthur’s (2009) list water entitlement data for four Basin States: NSW, Queensland, Victoria, and South Australia. The ACT was the only Australian Territory or State excluded from their scope. The data was the most comprehensive for the NSW jurisdiction, with water entitlement information listed for the remaining three Basin jurisdictions (Queensland, Victoria, and South Australia) appearing incomplete and/or inconsistent. This is partly due to low institutional understanding about Aboriginal water holdings at the time of this work, a tight timeframe in which to complete it, and limitations to entitlement register searching (Altman & Arthur, 2009).

When Altman and Arthur compiled their 2009 baseline there was (and still is) no straightforward way to identify water entitlements held by Aboriginal entities. State and Territory jurisdictions do not have any Indigenous “identifiers” in water entitlement registers. Entitlements held by Aboriginal organisations can, though, potentially be identified through searching water entitlement registers (where possible) for terms like, “Aboriginal”, “Indigenous”, “tribal”, etc., which often—but not always—appear in the names of Aboriginal organisations.

We began with Altman and Arthur’s 2009 dataset. For this project, out of scope licences in that database were excluded (entitlements for water sources outside of the Basin as well as entitlements under former water management frameworks that no longer exist)¹⁴. We also deployed a multi-pronged supplementary approach to identify other Aboriginal groups that (may) hold water entitlements currently. This was necessary due to limitations identified by Altman and Arthur (2009) as well as findings from Hartwig (2020) which indicate some changes to Aboriginal surface water holdings since 2009. The supplementary approach included:

- desktop searching for other Aboriginal organisations that held water licences, and/or large land grants in the MDB that may have included water transfers;
- asking the MDBA, as well as Basin State and Territory Aboriginal engagement staff from water agencies, about current Aboriginal water entitlement holders; and,
- searching other databases, including the Office of the Registrar of Indigenous Corporations, and land acquisition data collected by the MDBA.

By combining this with the amended Altman and Arthur 2009 baseline we generated a list of potential Aboriginal water holders. We then ran title searches to obtain details about the water entitlements for the 2020 baseline.

The ideal approach to searching title registers is presented in Figure 6. In summary, an *owner name search* for all identified (possible) entitlement holders should be run. Then, for each water entitlement revealed through an owner name search, a *title search* would be run to collect key information about those entitlements (e.g. volume of entitlement, water source, date of issue, etc.). Each State and Territory, however, has different title and register search options and capabilities, which necessitated deviation from this method.

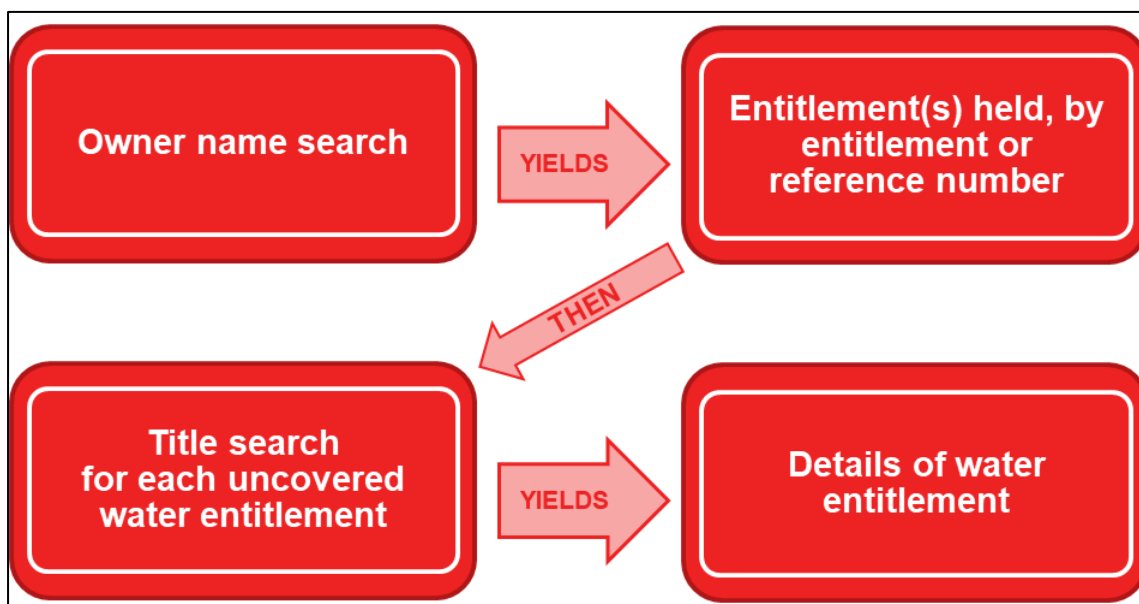


Figure 6: Ideal title register search approach for identifying Aboriginal held entitlements

Hartwig completed this exercise for the NSW portion of the MDB in October 2018 (Hartwig, 2020; Hartwig et al., 2020). To avoid duplicating this effort, while still uncovering any changes to Aboriginal water holdings since then, we used the NSW Government’s free online register (“NSW Water

¹⁴ For example, some former water licences issued under the *Water Act 1912* (NSW), were not converted to current aquifer water access licences under the *Water Management Act 2000* (NSW). In some cases, this is because the water access permitted under the former licensing framework was for stock and/or domestic purposes, which under the new regime is considered basic landholder rights and so an entitlement to take water is not required (s 52, *Water Management Act 2000*) (see also NSW Department of Primary Industries, 2015).

Register”, searches entitlement number only) to locate any permanent transfers of entitlements in the 2018 baseline. Any such changes then triggered further searches.

Victoria and South Australia currently do not offer owner name search functions in their water registers. This means, to search for water entitlement data, one must have the entitlement reference number. While sourcing this information is not impossible, it is difficult and can depend on the knowledge and cooperation of State agency staff and individual Aboriginal organisations (Altman & Arthur, 2009; Arthur, 2010). To overcome this challenge, we sought assistance from the relevant State agency staff who may have access to greater search functions. The SA Government staff were able to facilitate these owner-name based searches internally. Due to privacy policies, the Victorian Government was not able to provide the results of such searches in the detail and format required for consistent analysis and comparison with other jurisdictions. We also made several attempts to contact the ILSC to gain greater clarity about its water holdings, but received no response.

The overall approach to identifying Aboriginal held water entitlements was as thorough as possible. We still may have missed a very small number of entitlements and/or organisations because there is no systematic way to easily identify Aboriginal-held water entitlements in any individual State or Territory jurisdiction.

Standardising Aboriginal held water entitlements for comparison: Surface water

There are over 150 different surface water entitlements in the MDB (NSW Department of Industry, 2018b), and each water entitlement for each water source yields different average usable water volumes, even for the same level of entitlement reliability. A number of reasons account for this variability, including (but not limited to) regional differences in water availability (which affects the amount of water allocated to entitlements) and water storage infrastructure (which affects the opportunity for carrying over water allocations between years). Comparisons of different water entitlements are therefore difficult.

To manage these variations and inconsistencies, and following advice from the MDBA, we followed an approach used by the MDBA and Basin States to estimate and account for environmental water recovery as a means to “standardise” across Aboriginal-held water entitlements. The MDBA and Basin States developed long-term diversion limit equivalence (LTDLE) factors (often colloquially called “cap factors”) which, when applied to water entitlements, allows different types of entitlements within and across water sources to be compared on equal terms (NSW Department of Industry, 2018b). LTDLE factors range from 0 to 1 (or 0% to 100%), with a high value indicating greater long-term average water usage. An entitlement could have a LTDLE of 80%, or even as low as 20%, depending on the entitlement type and the water source. This means that available and usable volumes are usually less (sometimes significantly so) than the issued entitlement volumes (Wentworth Group of Concerned Scientists, 2010).

Basin States first developed LTDLE factors in 2011. In 2015, Basin Ministers agreed to review and update these to produce a more consistent and standardised approach. The NSW Government’s updated LTDLE factors were published in 2018 and finalised in early 2019 (see NSW Department of Industry, 2018b, 2019a, 2019b). The updated Victorian and South Australian LTDLE factors were released in late 2019 (SA DEW, 2019; Victoria DELWP, 2019). It is understood that at the time of writing, Queensland’s revised LTDLE factors are close to being settled, while in the ACT, no water has been recovered for environmental use, so such factors are not required (Tony McLeod, General Manager, SDL Accounting and Aboriginal Partnerships Branch, Water Resource Planning and Accounting Division, MDBA, *pers comm*, 13 July 2020). The updated 2018 and 2019 LTDLE factors were used in this exercise.

Importantly, these LTDLE factors do not dictate water use, nor inform water allocation decisions. Instead, they are intended to be a tool for representing historic water access and use in a consistent manner across all water entitlement types, water sources and jurisdictions (NSW Department of Industry, 2018b). Applying this method to Aboriginal water holdings is, therefore, expected to be of long-term value because it provides an accessible means of monitoring changes to these water holdings from this point forwards in a way that is consistent and compatible with new water accounting methods for the Basin.

LTDLE factors have only been developed, however, for entitlement types that have been, or are proposed to be, recovered for the environment (through direct purchases or water savings infrastructure projects) (SA DEW, 2019). This has often not included unregulated entitlements. For unregulated entitlements held by Aboriginal organisations without established LTDLE factors in NSW, we followed the assumptions of NSW Department of Industry (2018b), which nominated a LTDLE factor of 1.000 for unregulated entitlement types that have been recovered for environmental use. This assumption is deemed appropriate because only a very small volume of unregulated water has been recovered for environmental use, and so “the associated factors don’t significantly affect the overall water recovery balance” (NSW Department of Industry, 2018a, p. 1).

LTDLE factors were applied to each identified Aboriginal-held water entitlement, and subsequent LTDLE-volumes or what we term “standardised volumes” were recorded for each entitlement and SDL resource unit. Table 1 demonstrates the application of the LTDLE factors to Aboriginal-held water entitlements using the NSW Murray as an example. Throughout this report, we distinguish “standardised” surface water volumes as volumes per year (e.g. ML/y or GL/y).

Table 1: Applying LTDLE factors to Aboriginal water holdings in the NSW Murray SDL resource unit

NSW Murray Entitlements	Entitlement shares (ML)	LTDLE volumes (ML/y) ([total shares] * [LTDLE factor])
Stock & Domestic	42	42 * 0.623
High Security	8	8 * 0.873
General Security	5,588	5,588 * 0.699
Supplementary	258	258 * 0.703
Unregulated	104	104 * 1.000
Total	6,000	4,225

Source: Compiled from NSW Department of Industry (2018b), with assistance from Dr Marcus Finn, Senior Director of Water Resource Plans and Basin Policy at MDBA

We then compared LTDLE volumes for Aboriginal-held water entitlements with equivalent and comparable measures. The equivalent and comparable measures for surface water were environmental water recovery, BDL and SDL¹⁵ volumes. The MDBA developed BDLs and SDLs for each surface water SDL resource unit area by considering and estimating the LTDLE of water within seven forms of surface water “take”, using the best available information (MDBA, 2019c, 2019d). As this report focuses on Aboriginal-held water rights and access managed through State- and Territory-issued water entitlements, only equivalent forms of take were used to estimate these comparative measures (“take from a regulated river” and “take from a watercourse”). These equivalent and

¹⁵ SDLs were set to become the benchmark for consumptive water use from 1st July 2019, but there have been delays in some Basin States. Once SDLs do come into force, consumptive water use in each valley will be allowed up to the SDL, rather than the BDL. For surface water, SDLs are lower than BDLs and, therefore, it is worth considering Aboriginal water holdings as a proportion of not only BDLs but also the SDLs, where appropriate.

comparable volumes for recovered water (for environmental uses), BDLs and SDLs are listed in Appendix B.

Finally, while it is possible to convert a previous water entitlement baseline to LTDLE volumes,¹⁶ the previous baseline must be comprehensive. Some information was missing from Altman and Arthur's 2009 baseline for some jurisdictions, making such a conversion and then comparison difficult across the Basin. Limitations to water registers that make identifying changes to water entitlements over time also make verifying this baseline (or developing another) difficult. Issues relating to water registers are discussed further in Section 5. A complete list of limitations and assumptions underpinning this standardisation method and application of LTDLE factors is outlined in Appendix E.

Standardising Aboriginal held water entitlements for comparison: Groundwater

The method used for standardising surface water entitlements is not transferrable to the groundwater context. This is due to the static nature of BDLs and SDLs in groundwater (unlike surface water, which are dynamic), and that in all but two groundwater SDL resource units, the BDL is less than or equal to the SDL (see Schedule 4, *Basin Plan 2012*). LTDLE factors have been developed for only two groundwater SDL resource units where water recovery was required (MDBA, 2020b).

As a first step to standardising the Aboriginal-held groundwater water entitlements for, the MDBA suggested that groundwater entitlements across water sources across the Basin can be summed on a one-for-one basis, without needing to apply a conversion factor (like LTDLEs was used for surface water). This assumption means that the volumetric groundwater results cannot be combined with surface water holdings to provide an overall Aboriginal water holdings volumetric or proportional estimates across all MDB water sources. Indeed, combining surface water and groundwater volumes in this way is an uncommon practice in management of the Basin with both the MDBA and Bureau of Meteorology publishing annual accounts listing each water resource separately (see, for example, BOM, 2019b; MDBA 2019f).

We then needed to determine the correct baseline parameter for making proportional comparisons. The MDBA advised against comparing groundwater holding volumes with BDLs because BDLs were set using a different methodology for different SDL resource units and were only used to inform water recovery targets. Therefore, BDLs were not a suitable baseline parameter.

We next assessed the suitability of using groundwater SDLs as the baseline parameter. Unlike surface water, current groundwater users' requirements (including licensed volumes and water to meet basic landholder rights) are in many cases lower than the SDL. Water that is not currently assigned to any entitlement holder/s on a permanent basis in these groundwater systems is called "unassigned water" (NSW Department of Primary Industry – Water, 2017).

Not all Basin States have made all of this unassigned water available for use. For some SDL resource units, Basin States have made a portion available, though retain the ability to increase this up to the SDL should there be greater demand (see, for example, NSW Department of Primary Industry – Water, 2017). In some groundwater sources, then, the SDL represents what *may* be available in the future¹⁷ with respect to a potential growth in use rather than what is *actually* available for use now. Therefore, groundwater SDLs are not an accurate or appropriate indicator for an available resource baseline in all circumstances.

¹⁶ Some workarounds and fixes are required. See Hartwig (2020).

¹⁷ The potential opportunities (and challenges) this may present First Nations are discussed in Section 5.

So, as an alternative baseline parameter option, we considered using total volume of water access entitlements (WAE) on issue plus estimated take under basic rights (BR), both based on 2018-19 water year data. The total volume of WAE on issue is calculated by adding the volume of all entitlements to a given groundwater source on issue in a given water year. Take under BR is water that can be taken without an entitlement under State legislation. All Basin States have their own method of estimating annual take under BR.

We determined, however, that the total volume of WAE plus BR can exceed the SDL for some groundwater sources. Where this is the case, the total volume of WAE plus BR inaccurately suggests that more water is available than the SDL.¹⁸ Therefore, the total volume of WAE plus BR is not always an appropriate available resource baseline parameter.

As neither SDL nor the total volume of WAE plus BR are an accurate or appropriate baseline measure in all groundwater cases, we developed a tailored baseline measure termed *available groundwater resource*. The available groundwater resource is calculated based on the following considerations:

1. Where the total volume of WAE plus BR is less than or equal to the SDL, we can assume that the total volume of WAE plus BR is a good measure of the available groundwater resource. A comparison ratio of 1 is applied in these circumstances.
2. Where the total volume of WAE plus BR is greater than the SDL, the SDL is the better measure of the available groundwater resource. Therefore, we must scale back the total volume of WAE plus BR to equal the SDL, and in doing so, determine a comparison ratio (<1).

Comparison ratios were then applied to the total volume of identified Aboriginal groundwater holdings for the relevant water management area to determine the *comparable volume of Aboriginal groundwater entitlements* (see Appendix C). Where a comparison ratio of 1 is applied, the volumetric units remain unaltered. Where a comparison ratio of less than 1 is applied, however, the result will not be equivalent in volumetric terms nor, therefore, comparable to estimated volumes for other water management units at the same scale. In these instances, it is more appropriate to compare the calculated proportion or share (i.e. percentage) of available groundwater resources.

Development of comparison ratios in this way is based on the assumption that all groundwater entitlement holders utilise all of their available water every year, but this has not been observed in user behaviour in the past. For example, there are many “sleeper” groundwater entitlements which are entitlements that are not regularly accessed. Additionally, groundwater entitlement holders rarely use their full allocations. This means that even where the total volume of WAE plus BR exceed the SDL, users have not had allocations below 100%. This is observable in actual water use data published by the MDBA (2019f) and BOM (2019b).

The SDL, WAE, BR, and WAE + BR volumetric estimates (using 2018-19 water year data) along with the developed comparison ratio and calculated available groundwater resource for each water management area examined are presented in Appendix C.

Analysis and reporting

Several limitations pertaining to changing geographies limit the extent to which we have been able to compare the data presented in this report with previous analyses. First, different authors have

¹⁸ We note that such a situation is possible because (a) SDL is a *long-term* average measure that reflects take; (b) annual groundwater take is often considerably less than the volume of water allocated (and that on entitlement); and, (c) where the groundwater take does exceed the SDL, Basin States have compliance measures to rectify and manage the exceedance. In NSW, for example, if the long-term average annual extraction limit compliance test (established in Water Sharing Plans, which form part of NSW WRPs) is exceeded, initial water allocations in the next water year to aquifer entitlements may be less than 100%.

used different geographic units to estimate population figures. For example, the geographic units used by Taylor and Biddle (2004) are considerably different to those used by ABS et al. (2009). This could be due to changes to the way that Census data is now collected and reported. These inconsistencies can help to explain some unexpected trends noted in temporal comparisons (see, for example, Table 3 in Section 4).

Second, water management units within the MDB have changed over time, including during the last decade. Despite some similarities, the previously used Sustainable Yield Regions for surface water management for example, differ quite significantly overall from currently used SDL resource units. Thus, data reported here against SDL resource units is not comparable with that reported in publications that use Sustainable Yield Regions (see ABS et al., 2009; Arthur, 2010).

A scaffolding approach is used to present all baseline data in Appendix A (population data), Appendix B (surface water holdings), and Appendix C (groundwater holdings). The intention of this is to maximise the utility of the data for all potential users who may want information at different scales (e.g. MDBA, Basin State agencies, MLDRIN, NBAN, other Traditional Owner representative groups, other researchers, etc.). Figure 7 below uses Queensland water management units to show the scaffolding levels used to present the population data and surface water holdings. Northern and Southern Basins are defined according to that shown earlier in Figure 2.

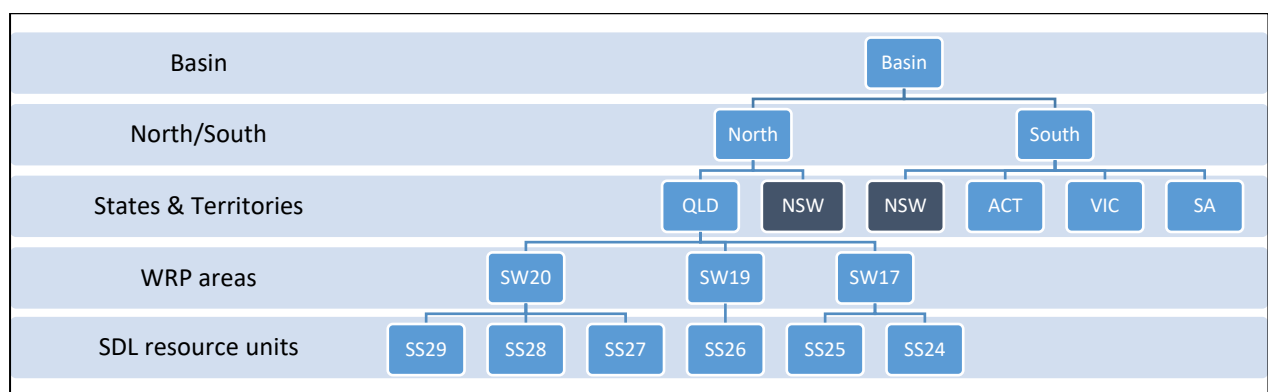


Figure 7: Scaffolding approach used to present population in Appendix A and surface water baseline data in Appendix B

Figure 8 below shows the scaffolding levels used to present groundwater holdings in Appendix C, again using Queensland water sources as an example. With so few Aboriginal entities with groundwater entitlements identified, it was decided to not present Aboriginal groundwater holding data at the SDL resource unit scale to protect confidentiality.

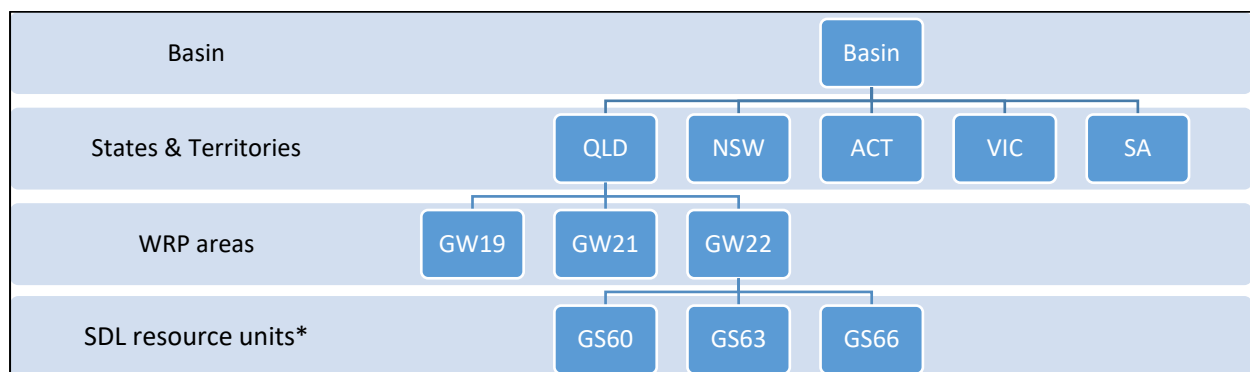


Figure 8: Scaffolding approach used to present groundwater baseline data in Appendix C

Note: *For the SDL resource unit level, Aboriginal groundwater holding data is not presented in the interest of confidentiality, and only SDL, total volume of water entitlement on issue plus basic rights, comparison ratio, and available groundwater resource are presented for that level.

4. Findings

Indigenous population

Population findings are presented from the largest (Basin-wide) to smallest scale (surface water¹⁹ SDL resource units) using 2016 ERP data. Population changes over time are discussed where possible, but the extent is limited by the number of historic analyses, as well as issues previously discussed. Indigenous²⁰ population figures and total population figures by SDL resource unit, WRP area, State and Territory portion, and Basin are presented in Appendix A.

Basin-wide

Our analysis shows that in 2016, the Indigenous ERP in the MDB was 120,487, representing 5.3% of the total MDB population (2,252,123 persons), as shown in Table 2. Over half of this MDB Indigenous population live within the Northern Basin (64,739 Indigenous persons). In this region, Indigenous peoples also constitute 10.5% of the total ERP in this area. By contrast, 46.3% of the total MDB Indigenous population live in the Southern Basin (55,748 Indigenous persons). Here, Indigenous people constitute a 3.4% share of the total ERP. In other words, a greater proportion of the Basin's total Indigenous population lives in the north of the Basin where the Indigenous share of the population is more than three times that of the south.

Table 2: Indigenous and non-Indigenous ERPs of the MDB, 2016

Region	Indigenous ERP	Non-Indigenous ERP	Total ERP
Total Murray-Darling Basin	120,487	2,131,636	2,252,123
<i>Northern Basin</i>	<i>64,739</i>	<i>554,325</i>	<i>619,064</i>
<i>Southern Basin</i>	<i>55,748</i>	<i>1,577,311</i>	<i>1,633,059</i>

Overall, the total 2016 MDB Indigenous population constitutes a 15.1% share of the total national Indigenous population (798,333 Indigenous persons). By comparison, the total MDB population (2,252,123 persons) constitutes 9.0% of the total national population (24,190,581 persons).

In 2004, Taylor and Biddle offered preliminary MDB Indigenous population projections for 2016. While their methods were underpinned by a number of assumptions and limitations (see Taylor & Biddle, 2004), contrasting these projections with the actual 2016 ERP figures is an interesting exercise. Their low series estimate, which was based on demographic factors alone, was 84,543 Indigenous persons following a modest 1.5% per annum growth rate. However, as noted earlier, other non-demographic factors commonly see higher than expected intercensal population growth for Indigenous population in Australia (see Taylor & Biddle 2004, 2010).²¹ Taylor and Biddle's (2004) high series estimate, which accounted for these other non-demographic factors, predicted a very high growth rate of 4.6% per annum, culminating in a 2016 Indigenous population projection of 116,551. Given the considerable uncertainty of these estimates, Taylor and Biddle (2004) predicted that the 2016 Aboriginal MDB population would be somewhere between the two estimates. Analysis

¹⁹ All references to SDL resource units and WRP areas in the Indigenous population findings section are surface water management units.

²⁰ A reminder: we reserve the use of the term "Indigenous peoples/persons" for when describing Census population and demographic statistical information, which combines those people that identify as having Aboriginal and/or Torres Strait Islander origin.

²¹ Non-demographic factors contributing to this intercensal change include changes in the ways that respondents identifying themselves as being of Aboriginal and/or Torres Strait Islander in Census surveys, identification of children from mixed Indigenous-non-Indigenous partnerships identifying as Indigenous and improving Census methodologies (See Markham & Biddle, 2018).

here, though, shows the Indigenous ERP from the 2016 Census (120,487) in fact exceeds their high series estimate by close to 4,000 people.

Based on the 2016 population figures presented already and those from previous analyses (see Table 3), from 2001 to 2016 the total Indigenous population in the MDB increased by an estimated 43% or 2.8% per annum averaged over this time.²² This rate of growth is more than five times greater than the non-Indigenous population rate, which was estimated to be 8.0% or 0.5% per annum over the same period. Taylor and Biddle (2004) reported a similar relationship between Indigenous and non-Indigenous population growth rates from 1996 to 2001. As a result of this sustained comparatively higher Indigenous population growth rate, the Indigenous share of the total MDB population has increased from 3.4% in 2001 (Taylor & Biddle, 2004) to 5.3% in 2016. Should these Indigenous and non-Indigenous population growth and migration trends continue, the Indigenous share of the total MDB population is only likely to continue to grow into the future. Hartwig et al. (In review) estimate, for example, that if recent growth trends are extrapolated to 2031, Indigenous peoples could constitute over 16% of the total population in the NSW portion of the MDB.

Table 3: Indigenous and non-Indigenous ERPs of the MDB as reported in different sources from 2001 to 2011

Census year (relevant analysis citation)	Indigenous population	Non-Indigenous population	Total population
2011 (Wentworth Scientists, 2017)	84,015	2,016,518	2,100,533
2006 (ABS et al., 2009)	69,481	2,020,294	2,089,775
2001 (Taylor & Biddle, 2004)	68,656	1,960,099	2,028,755

Note: Considerably different statistical scales of analysis were used by Taylor and Biddle (2004) and ABS et al. (2009).

State and Territory portions of the MDB

Figure 9 shows the current distribution of the Indigenous population across the portions of State and Territory jurisdictions that fall within the Basin, using 2016 ERP data. The largest proportion of the Basin's Indigenous population resides in NSW (65.1%), where Indigenous peoples constitute a 9.3% share of the total population. Similar sized Indigenous populations live in the Victoria-MDB portion (15,481 Indigenous persons and 12.8% of total) and Queensland-MDB portion (14,910 Indigenous persons and 12.4% of total), but the Indigenous share of the Queensland-MDB total population (6.0%) is greater compared to the Victorian-MDB (2.4%). The ACT has the fourth largest Indigenous population (7,456 Indigenous persons and 6.2% of total), followed by South Australia (4,162 Indigenous persons and 3.5% of total).

²² We acknowledge that the units of analysis may not align between our 2016 data analysis and Taylor and Biddle's 2001 data analysis.

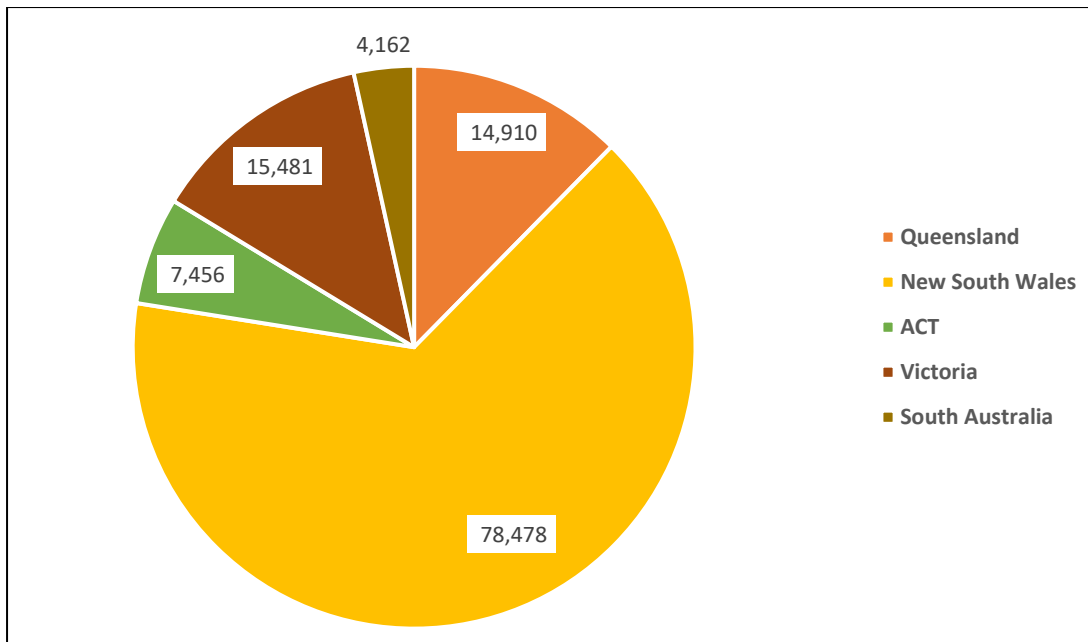


Figure 9: Distribution of total MDB Indigenous population by State and Territory MDB portions, 2016 ERP data

Taylor and Biddle (2004) provided similar State and Territory based Indigenous population estimates using 2001 Census data. Their findings are summarised alongside 2016 ERP statistics in Table 4. While the proportional distribution of Indigenous persons across the State and Territory jurisdictions in 2016 is similar compared with 2001, the total number of individuals has increased considerably. Of note, in 2016 the NSW portion of the MDB was home to more Indigenous peoples by number (78,478 Indigenous persons) than there were estimated across the whole MDB in 2001 (68,656 Indigenous persons). Figure 10 graphically represents the change in Indigenous population by State and Territory jurisdictions over time.

Table 4: Indigenous and total population distribution across State and Territory portions of the MDB, 2001 and 2016

Region	Indigenous population		Total population		Spatial distribution of total MDB Indigenous population (%)		Indigenous proportion of total population for specified area (%)	
	2001	2016	2001	2016	2001	2016	2001	2016
Total	68,656	120,487	2,028,755	2,252,123	100	100	3.4	5.3
NSW	45,781	78,478	809,153	841,371	66.7	65.1	5.7	9.3
Queensland	9,067	14,910	235,780	248,004	13.2	12.4	3.8	6
Victoria	7,839	15,481	595,948	634,508	11.4	12.8	1.3	2.4
SA	5,969	4,162	387,874	125,656	8.7	3.5	1.5	3.3
ACT		7,456		402,584		6.2		1.9

Note: Taylor and Biddle (2004) do not separate SA and ACT population figures. 2001 and 2016 units of analysis may not perfectly align.

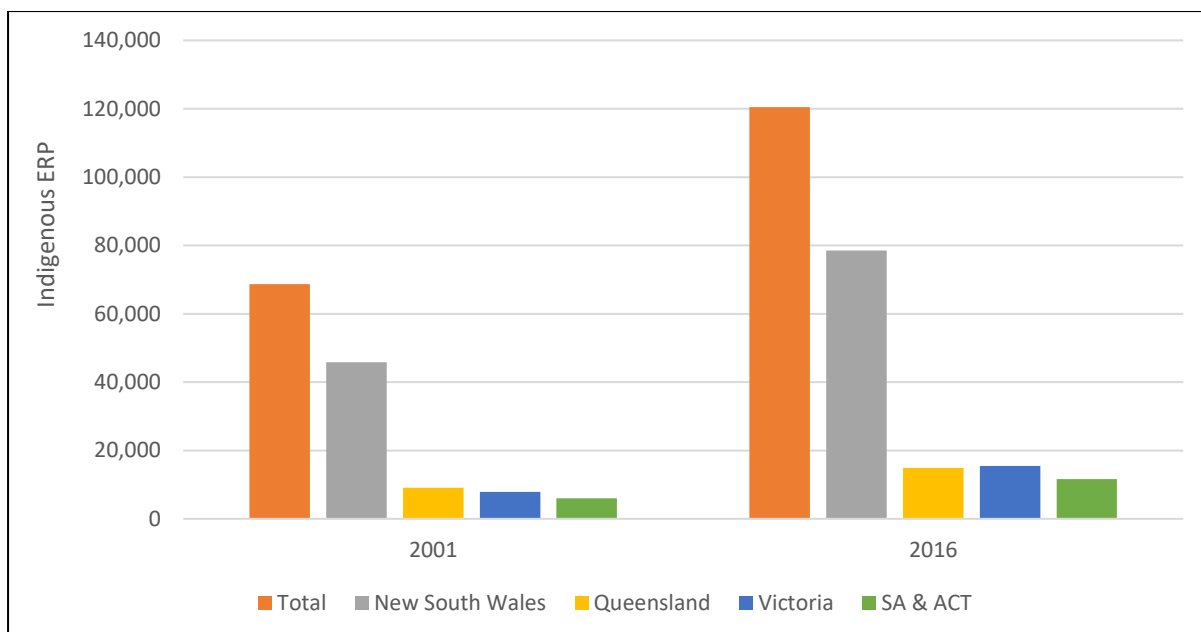


Figure 10: Indigenous ERP by State and Territory portions of the MDB, 2001 and 2016

Note: Taylor and Biddle (2004) do not separate SA and ACT population figures. 2001 and 2016 units of analysis may not perfectly align.

SDL resource units

Table 5 presents key population statistics by SDL resource unit, ordered from largest to smallest Indigenous population. As noted earlier, the Barwon-Darling Watercourse SDL resource unit (and WRP area) only includes the watercourse i.e. the river channel, and not any adjacent areas—and therefore not the adjacent townships (see Figure 1 earlier). Populations that live along or adjacent to this SDL resource unit are therefore captured in the population estimates for neighbouring SDL resource units—predominantly Intersecting Streams, but also the Lower Darling, Macquarie-Castlereagh, Gwydir, and NSW Border Rivers SDL resource units. Readers should not interpret this to mean that no (Indigenous or non-Indigenous) people live along the Barwon-Darling Watercourse.

Interestingly, Table 5 shows that more than half (54.5%) of the MDB Indigenous population live in only four SDL resource unit areas, three of which are located in NSW. More specifically, the Macquarie-Castlereagh SDL resource unit had the largest Indigenous ERP in 2016, with 25,524 Indigenous persons representing 21.2% of all Indigenous persons in the MDB. The Namoi and Murrumbidgee SDL resource units had the second and third largest number of Indigenous persons (13,804 and 13,778, respectively). Condamine-Balonne, in Queensland, has the fourth largest Indigenous population with 12,478 Indigenous persons.

Table 5: Key ERP statistics across the MDB by SDL resource unit in order of Indigenous population size

SDL resource unit	State	Indigenous ERP	Total ERP	Proportion of total MDB Indigenous population (%) [See Figure 11]	Indigenous population as proportion of total SDL resource unit population (%) [See Figure 12]
Macquarie-Castlereagh	NSW	25,542	206,042	21.2	12.4
Namoi	NSW	13,804	98,352	11.5	14.0
Murrumbidgee	NSW	13,778	248,170	11.4	5.6
Condamine-Balonne	Qld	12,478	216,875	10.4	5.8
Lachlan	NSW	8,051	96,223	6.7	8.4
ACT (surface water)	ACT	7,456	402,584	6.2	1.9
Victorian Murray	Vic	4,248	112,235	3.5	3.8
Gwydir	NSW	4,017	24,810	3.3	16.2
Goulburn	Vic	3,987	138,997	3.3	2.9
Lower Darling	NSW	3,530	27,854	2.9	12.7
NSW Border Rivers	NSW	3,447	30,951	2.9	11.1
NSW Murray	NSW	3,290	98,064	2.7	3.4
Intersecting Streams	NSW	3,019	10,905	2.5	27.7
Loddon	Vic	2,863	47,811	2.4	1.9
SA Non-Prescribed Areas	SA	2,794	63,836	2.3	4.4
Kiewa	Vic	1,284	47,875	1.1	2.7
Eastern Mount Lofty Ranges	SA	1,163	52,848	1.0	2.2
Warrego	Qld	1,138	5,869	0.9	19.4
Queensland Border Rivers	Qld	1,133	23,010	0.9	4.9
Wimmera-Mallee	Vic	1,106	63,491	0.9	1.7
Campaspe	Vic	956	55,911	0.8	1.7
Ovens	Vic	709	49,996	0.6	1.4
Broken	Vic	328	18,192	0.3	1.8
SA Murray	SA	192	7,519	0.2	2.6
Moonie	Qld	69	888	0.1	7.8
Nebine	Qld	68	1,095	0.1	6.2
Paroo	Qld	24	267	0.0	9.0
Marne Saunders	SA	13	1,453	0.0	0.9
Barwon-Darling Watercourse*	NSW	n/a	n/a	n/a	n/a

Note: *The Barwon-Darling Watercourse SDL resource unit only includes the watercourse i.e. the river channel, where no one lives.

Figure 11 shows the spatial distribution of the total MDB Indigenous population i.e. in what regions Indigenous populations live. The SDL resource units where Indigenous people live in the greatest numbers are shaded in darkest orange. The larger number of Indigenous peoples identified in these areas is likely due in part to each encompassing one or more sizable populous townships. For example, Dubbo and Orange in Macquarie-Castlereagh, Tamworth and Walgett in Namoi, Wagga Wagga and Griffith in Murrumbidgee, and Toowoomba in Condamine-Balonne. This map does not include information about non-Indigenous populations.



Figure 11: Spatial distribution of the MDB Indigenous population (as a proportion of the total MDB Indigenous population) by SDL resource unit, based on 2016 ERP

Figure 12 presents the Indigenous population as a proportion of total population (that is Indigenous and non-Indigenous) for each SDL resource unit (see last column in Table 5). Darker green shading in this figure indicates areas where Indigenous peoples constitute a larger proportion of the total SDL resource unit population. The three SDL resource units with the highest Indigenous population as a proportion of the total population were Intersecting Streams (27.7%), Warrego (19.4%), and Gwydir (16.2%).

Figure 12 shows that the Northern Basin and/or more remote areas generally have populations with higher proportions of Indigenous people. This finding is consistent with past research (see ABS et al., 2009; Taylor & Biddle, 2004).

One particular strength we see from this graphic is that it clearly demonstrates that Indigenous peoples constitute at least 5% of most SDL resource unit populations in Queensland and NSW. Indeed, Indigenous peoples constitute more than 10% of the total population in six of the nine populated²³ NSW SDL resource units. These are significant observations that do not seem to be well appreciated in water management and broader policy and planning circles.

On the other end of the spectrum, this figure also shows that Indigenous persons make up less than 5% of the total population in most Victorian and SA SDL resource units, and less than 1% in only one SDL resource unit (Marne Saunders, near Murray Bridge in SA). In interpreting this, it is crucial to remember that the combined Indigenous populations of the Victorian and SA SDL resource units represents 16.3% of the total MDB Indigenous population. This shows how it is possible that in these more southern areas, Indigenous populations (and Aboriginal water issues, priorities, and goals) may be more easily over-shadowed by the interests of the much larger non-Indigenous populations.

²³ As noted, Barwon-Darling Watercourse SDL resource unit is not considered populated due to only containing the river channel.

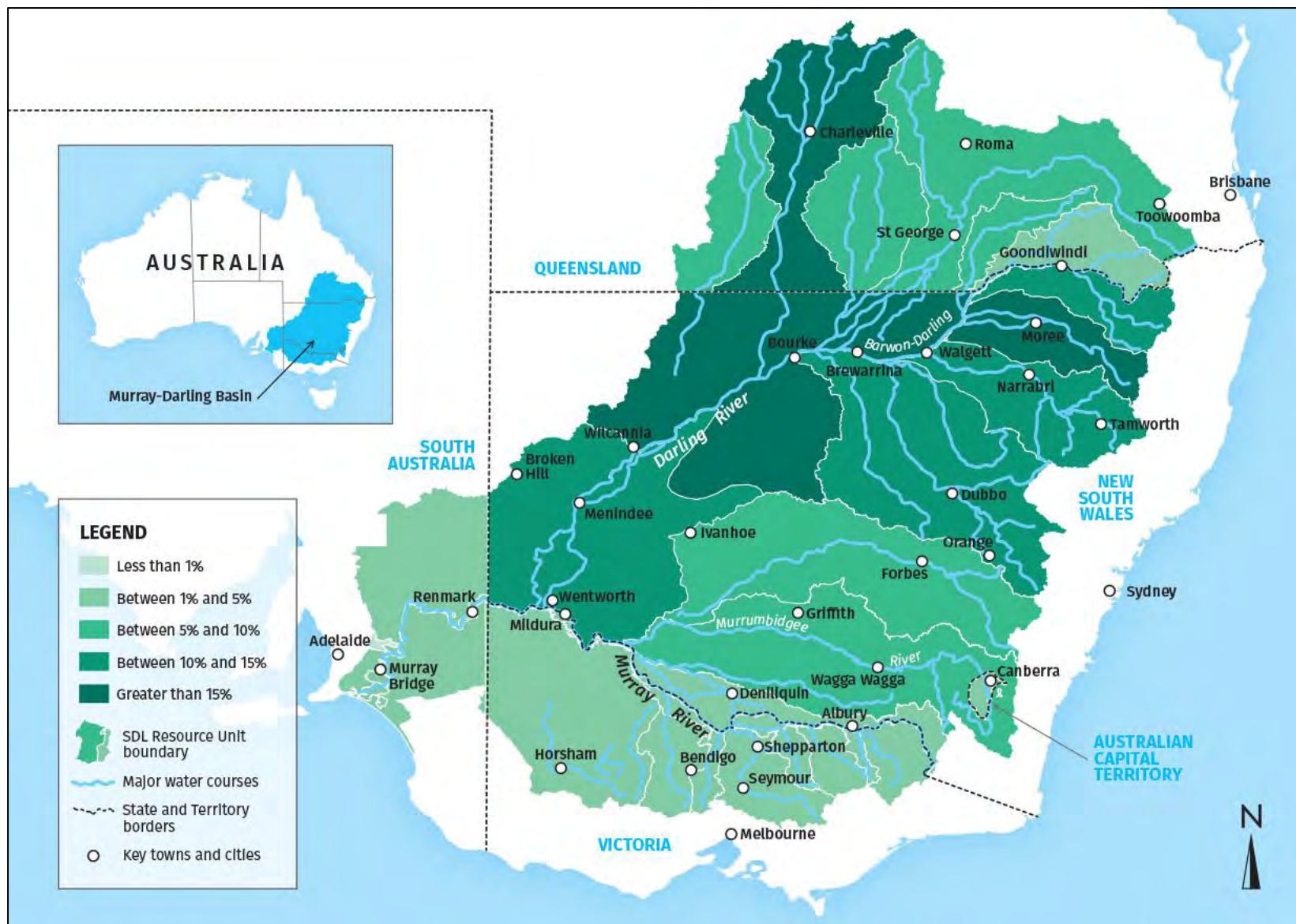


Figure 12: Indigenous proportion of the total population in each SDL resource unit, based on 2016 ERP

We note that these figures may give the impression that the Indigenous population is distributed evenly within individual SDL resource units. In reality, populations are generally concentrated in towns or settlements. Hartwig et al. (In review) show that townships and settlements in the NSW portion of the MDB are generally located adjacent to rivers. This is particularly the case for settlements with high Indigenous population proportions, such as in Western NSW. Even in the most sparsely settled parts of NSW, Indigenous populations continue to occupy riverside towns and communities with declining non-Indigenous populations (Hartwig et al. In review).

Aboriginal water holdings: Surface water

In this section, we describe identified surface water entitlements that are held by Aboriginal organisations²⁴ and their spatial distribution at Basin, State and SDL resource unit scales. Commentary about Aboriginal-held water entitlements in each jurisdiction is offered, including possible reasons that led to the acquisition of entitlements by Aboriginal entities. Next, the composition of entitlement types held by Aboriginal entities is examined. This provides insights into the reliability of water access and the market value of the entitlements. To conclude, we briefly compare water recovered for environmental purposes with Aboriginal-held water, and then, looking to the very near-future, present Aboriginal water holdings as proportions of SDLs.

The Victorian Government provided a high-level summary of water holdings held by Traditional Owners in Victoria, however this data could not be converted to LTDLE volumes. As detailed earlier, this format is necessary for consistent analysis and comparison with other jurisdictions. As a result, Victoria is excluded from some aggregate figures presented in the following discussion. Where possible, we make comment on Aboriginal-held Victorian water entitlements based on other anecdotal evidence such as from conversations with Victorian agency staff and data presented in ACCC's (2020) Interim Report from its ongoing MDB Water Market Inquiry.

Spatial distribution and character of identified Aboriginal surface water holdings in the MDB

Across the MDB, we found that at least²⁵ 30 Aboriginal entities hold surface water entitlements to 12.774 GL/y of water under 64 water entitlements.²⁶ The LTDLE volumes of individual entitlements range from 0 ML/y²⁷ to 1,858 ML/y²⁸. These Aboriginal water holdings constitute a mere 0.17% of the equivalent take BDL in the corresponding Basin States only (i.e. excluding Victoria's equivalent take BDL), or 0.12% of the whole Basin's equivalent take BDL (i.e. including Victoria's equivalent take BDL). If we also account for Aboriginal water holdings in the Victorian portion of the Basin,²⁹ we expect that Basin-wide Aboriginal water holdings would altogether, as a very generous estimate, constitute only up to 0.17% of the whole Basin's equivalent take BDL.

This figure of 0.17% is slightly larger than other estimates of Aboriginal water holdings to date. Jackson and Langton's (2012) often-cited figure of "less than 0.01%" is much smaller because it only concerns "Indigenous-specific water entitlements", whereas our analysis here includes all entitlements that are held by Aboriginal entities. (We return to "Indigenous-specific water entitlements" again shortly.) In 2015, MLDRIN chair Darren Perry estimated Aboriginal water holdings constituted 0.08% of the Basin's SDL. While the method used to calculate this figure was

²⁴ As a reminder, there is no available data about water entitlements that are held by Aboriginal individuals.

²⁵ While Aboriginal water holdings in Victoria are uncouncted, we leave open the possibility of a higher total.

²⁶ Five of these entitlements include two parts. One entitlement is held by multiple holders, and so for that entitlement, the Aboriginal entity is only a part holder.

²⁷ Two entitlements are for 0 ML/y. Such an entitlement grants the owner no ongoing volumetric water right but is typically used to facilitate purchasing temporary water allocations or permanent share components.

²⁸ This largest entitlement is held by the ILSC and is pledged to be transferred to an Aboriginal organisation.

²⁹ By drawing on anecdotal evidence such as from conversations with Victorian agency staff and data presented in ACCC (2020).

not outlined by Perry (2015), he drew from Arthur’s (2010) data that, to some extent, adds different entitlement shares together. As noted in Section 3 of this report, this is not advisable. What is consistent across these different estimates, however, is that Aboriginal water holdings are miniscule as a proportion of the total pool of available water.

As shown in Table 6, the largest volume of water held by Aboriginal entities in the MDB is located in the NSW portion (93.9% or 11.992 GL/y), followed by the SA portion (6.1% or 0.782 GL/y). No Aboriginal water holdings were identified in Queensland or the ACT.

Table 6: Distribution of Aboriginal water holdings across the State and Territory portions of the MDB

Area	LTDLE water held (GL/y)	Portion of all Aboriginal-held water (%)	As a share of the equivalent BDL for the area (%)
Queensland	0	0	0
NSW	11.992	93.9	0.21
ACT	0	0	0
Victoria	Data unavailable	Data unavailable	Data unavailable
South Australia	0.782	6.1	0.11
Total Basin (inc Vic)	12.774	100	0.12
Total Basin (exc Vic)	12.774	100	0.17

Note: BDL figures are included in Appendix B.

Before progressing to examine the distribution and character of Aboriginal water holdings at these State and Territory jurisdictional scales, we pause to highlight the degree of underrepresentation of Aboriginal water rights in the MDB as revealed through contrasting Aboriginal water holdings (as a proportion of total water holdings) with the earlier described Indigenous population estimates (as a proportion of total populations). Importantly, in doing, we do not imply that parity of population and water holdings should be *the* measure of equity or fair water distribution in the Basin either now or in the future. Instead, we see such a parity as one among many possible forms and indeed, one that is certainly open to discussion. Ultimately, measures of equity need to be informed by and determined with Traditional Owners (Hartwig et al., 2020).

In the interim, we include this exercise to develop and offer important insights about the degree of underrepresentation and inequity of Aboriginal water rights in the MDB. While the following insights are useful and important, they are *indicative* only and should not be interpreted or treated otherwise.

Across the whole Basin (excluding Victoria), Indigenous peoples represent 6.5% of the total population. By comparison, Aboriginal entities hold 0.17% of the available surface water, as shown in Table 7. When looking regionally across the Northern and Southern Basins (excluding Victoria), an even more concentrated disparity is revealed. As displayed in Table 7, in the Northern Basin, Aboriginal peoples constitute a larger proportion of the total population (10.5%, compared to 4.0% in the south) and of the total MDB Aboriginal population (61.7%, compared to 38.3% in the south). Yet, Aboriginal entities in the Northern Basin hold a smaller fraction of available water (0.11%, compared to 0.21% in the south). As the later section shows, the main types of water entitlements that Aboriginal entities hold—especially in the Northern Basin—further amplifies this underrepresentation.

In sum, using this water to population proportion exercise as an indicative measure of water equity reveals first and foremost that Aboriginal water access across the *whole* Basin is inadequate and

inequitable. Secondly, it indicates that this disparity is particularly concentrated in the Northern Basin.

Table 7: Population and water distributions across the Northern and Southern Basins

Category	North		South*		Total*
	Number	Percent	Number	Percent	
Total water (GL/y)	2,416	32.9%	4,921	37.1%	7,337
Aboriginal-held water (GL/y)	2,684	21.0%	10,090	79.0%	12,774
Aboriginal-held water as a proportion of total water (2020)	-	0.11%	-	0.21%	0.17%
Total population	619,064	38.3%	998,551	61.7%	1,617,615
Aboriginal population	64,739	61.7%	40,267	38.3%	105,006
Aboriginal population as a proportion of total population (2016)	-	10.5%	-	4.0%	6.5%

Notes: *Excluding Victoria.

We now move to describe Aboriginal water holdings in each of State and Territory jurisdiction portion of the Basin more closely including, where possible, how entitlements were initially acquired and any known changes over time.

New South Wales

In the NSW portion of the MDB, 24 Aboriginal organisations hold 54 entitlements to a total of 11.992 GL/y of water that, as noted, constitutes the majority of known Aboriginal water holdings across the Basin. Twelve of these organisations are Local Aboriginal Land Councils, constituted under the NSW *Aboriginal Land Rights Act 1983 (ALRA)* and 11 are Aboriginal Corporations, Associations or Housing Cooperatives constituted under various legislation. The remaining organisation is the ILSC.

Hartwig et al. (2020) identify several reasons that help to explain how Aboriginal entities in this area hold a comparatively larger—though still very small in an absolute sense—volume of water than other State and Territory jurisdictions. They show that Aboriginal water entitlements in NSW were acquired through land transfers under land rights restitution regimes and land purchasing programs offered by both the Federal and NSW Governments over the last 40-50 years, mostly prior to the unbundling of land and water rights under water reforms from the early 2000s (Hartwig et al., 2020). The land (and water) transfers made possible through Federal regimes apply across Australia and explain the acquisitions of at least some water holdings in SA and Victoria as well (Altman & Arthur, 2009). Indeed, the loans and grants offered by the ILSC remain a means by which Aboriginal entities across Australia may come to acquire water entitlements today. Until 2018, this could only occur through combined land and water acquisitions. Recent legislative change (see ILSC, 2018) makes it possible that water entitlements alone (and unconnected to land titles) can now be acquired as well.

The land and water transfers to Aboriginal entities that occurred in NSW via measures under the *ALRA* are unique to NSW, and likely contribute to the comparatively greater volume of water held by Aboriginal entities in this region (Hartwig et al., 2020). These transfers included former Aboriginal Reserves and direct property purchases on the open market, the latter of which seems unique to NSW's land rights legislative model. Some Local Aboriginal Land Councils also hold properties purchased under the above-mentioned Federal land restitution arrangements.

Importantly, Hartwig et al. (2020) clarify that although these land restitution processes that started in NSW in the 1970s enabled some water rights reacquisition, the extent was significantly constrained. This is because these land rights regimes intentionally restricted what land Aboriginal people could claim—they were biased against Aboriginal organisations acquiring or claiming properties with agricultural potential and, therefore, water entitlements. Coinciding with this land rights era, was the “closure” of water resources to new water licence applications (Hartwig, 2020; Jackson, 2017). Now the only option available to Aboriginal organisations to access was to purchase water entitlements on the open market.

As a result, and in combination with the absence of government commitments to restore water rights to Aboriginal communities when these rights were restructured (Jackson & Langton, 2012; McAvoy, 2006), a markedly inequitable pattern of water holdings in the NSW-MDB portion has endured. That is, NSW is the largest area of the Basin and is the jurisdiction with the largest LTDLE water volumes on issue. As already observed, 78,478 Indigenous persons live in this region of the MDB, constituting 9.3% of the area’s total population. Yet, Aboriginal entities here hold just 11.992 GL/y, or a mere 0.21% of the NSW BDL.

Of significance, Hartwig et al. (2020) also found that Aboriginal water holdings in the NSW portion of the MDB declined between 2009 and 2018 by at least 17.2% (2.0 GL/y). The most significant factor that contributed to this decline was forced permanent water sales associated with liquidation and insolvency processes. Possible reasons for liquidation are numerous, but generally are attributable to ineffectual governance arrangements and/or difficulties in establishing and maintaining financial viability as required by legislation. Pressures that affect the financial viability of Aboriginal landholding organisations are well known (see, for example, Chalk & Brennan, 2015; Norman, 2015). Hartwig et al. (2020) also observed that some Aboriginal held entitlements remain vulnerable to further losses into the future. (Indeed, some small losses between 2018 and 2020 have been observed, but reasons for these declines are unknown.)

Most of the 17.2% decline affected Aboriginal water holdings in the Southern Basin portion of NSW. Those entitlements identified as at risk were all in the Northern Basin portion of NSW (Hartwig, 2020). Therefore, this is not an isolated challenge—resources and support are needed to halt further water losses across the NSW portion of the MDB. Indeed, this may be of relevance for Aboriginal water holding entities beyond NSW. Such declines in Aboriginal water holdings would further reduce options for Aboriginal communities to enjoy the purported benefits of water access and water market participation.

A final point about NSW is that it uniquely offers Indigenous-specific water entitlements (see Jackson & Langton, 2012; Tan & Jackson, 2013). It is conceivable that such entitlements could be included in the baseline. However, some types are not available in the Basin and of those that are few have been applied for and/or granted since introduced in 2004 (see Hartwig, 2020; Jackson & Langton, 2012; Sefton et al., 2020). As at early 2020, there was only one such entitlement on issue to a surface water source within the Basin—specifically, the Murrumbidgee Regulated Water Source. This entitlement is held by the Riverina Local Land Services (LLS), a non-Aboriginal government entity. While this entity intends to use this water for Aboriginal-directed purposes (Riverina LLS, 2018), we exclude this entitlement from the baseline because it is not held by an Aboriginal organisation.³⁰

³⁰ Notably, in 2009, this water was held by an Aboriginal entity and used for cultural/environmental watering. Seeing as this is no longer the case in 2020, it constitutes a small portion of the aforementioned 17.2% loss of Aboriginal water holdings reported by Hartwig et al. (2020) (see also Hartwig, 2020).

South Australia

In the 2020 baseline, six Aboriginal entities hold 10 entitlements, all to the SA Murray regulated water source. Five of these entitlements include Class 1 and Class 3 components. By number of entitlements, most are Class 1 (for stock and domestic uses) (33 ML/y, 4% of all Aboriginal-held water in SA) and/or Class 3 (for irrigation uses) (444 ML/y, 57%). One entity holds a Class 5 entitlement (305 ML/y, 39%) which is considered an industrial entitlement (i.e. may be used for aquaculture).

Overall, several Aboriginal-held SA water entitlements were acquired via (former) ILC land purchasing programs (Altman & Arthur, 2009), but the means of acquisition for others is not known. Four of these identified entitlements (held by three Aboriginal entities) were identified in Altman and Arthur's 2009 scoping exercise. In fact, these were the *only* Aboriginal-held entitlements they found across all of SA at that time. The volumes of two entitlements listed by Altman and Arthur (2009) have changed—one is now 0 ML, while another is now 100 ML larger.³¹ The timing and reasons for these changes are unknown. The newly identified six entitlements are held by entities that do not have an "Aboriginal" identifier in their names. Given this was a central approach to the searching strategy of Altman and Arthur (see Section 3), it is possible that these entitlements were also Aboriginal held in 2009. Further research is required to determine when and how Aboriginal-held entitlements were acquired in SA and any changes over time.

Overall, Indigenous persons make up a 3.3% share of the 2016 ERP for the SA portion of the MDB, while Aboriginal entities hold 0.11% of all LTDLE water in SA. Like the situation in the NSW-MDB, this represents a significant disparity on the basis of population share.

Queensland & ACT

In 2009, Altman and Arthur identified a number of Aboriginal-held water entitlements as well as organisations that possibly held entitlements in Queensland. Within the MDB portion of Queensland, they only identified possible holders. Searching the names of these entities, as well as several others suggested by Queensland Government staff in early 2020, the Queensland *Water Allocations Register* revealed that none actually hold water entitlements in the MDB. In other words, while Indigenous peoples represent a 6.0% share of the total population in the Queensland portion of the MDB, Aboriginal entities hold no share of the available water use entitlements.

The ACT was not included in Altman and Arthur's scoping study. The ACT has the smallest LTDLE volume across the Basin States and Territories. Here, Aboriginal entities hold no water use entitlements, despite an Indigenous population of almost 7,500, who constitute a 1.9% share of the total ACT population.

Victoria

Evidence suggests there are Aboriginal-held water entitlements in the Victorian-portion of the MDB, but specific details are not available. For instance, Altman and Arthur (2009) reported extremely limited details about actual water entitlements held by Aboriginal entities in Victoria. More recently, a confidential report by Aither (2018) commissioned by the Victorian Department of Environment, Land, Water and Planning identifies a handful of Aboriginal organisations that hold water entitlements across the State, but specific entitlements and locations are confidential. At least some entitlements are known to have been acquired through (former) ILC purchases, as described in other jurisdictions (Altman & Arthur, 2009; Jackson, Moggridge & Robinson, 2010). Anecdotal evidence

³¹ Altman and Arthur (2009) list the former, as 694.7 ML/y and the latter as 46.0 ML/y. Both are Class 3 entitlements.

such as that reported in ACCC (2020) indicates, though, that the volume of Aboriginal-held water in the Victorian portion of the MDB is, like other jurisdictions, extremely small.

Distribution by SDL resource units

Figure 13 shows the distribution of known Aboriginal water holdings by SDL resource unit across the Basin. Ten of the 11 SDL resource units where we identified Aboriginal-held water are in NSW. The largest Aboriginal-held volume is within the NSW Murray SDL resource unit (4.225 GL/y), closely followed by the Murrumbidgee SDL resource unit (3.954 GL/y). However, as total long-term water extractions are greatest in these two SDL resource units (1,707.7 GL/y, and 2,117 GL/y respectively), these Aboriginal holdings constitute 0.25% and 0.19% of all water available in each. The SDL resource unit where the portion of water held by Aboriginal organisations is largest is the Lower Darling (1.64% or 0.902 GL/y) and the smallest is the Gwydir (0.01% or 0.031 GL/y).

Figure 14 shows the spatial distribution of Aboriginal water holdings per SDL resource unit. Here, areas that are shaded in darker purple denote areas where comparatively larger volumes of water are held by Aboriginal entities. Recall that the total volume of water held by and distributed among Aboriginal entities across the whole Basin is 0.17% of the BDL (excluding Victoria).

We note that these figures may give the impression that the Aboriginal water holdings are distributed evenly within each individual SDL resource unit. In reality, water holdings are generally concentrated in some river systems and water sources within these areas.

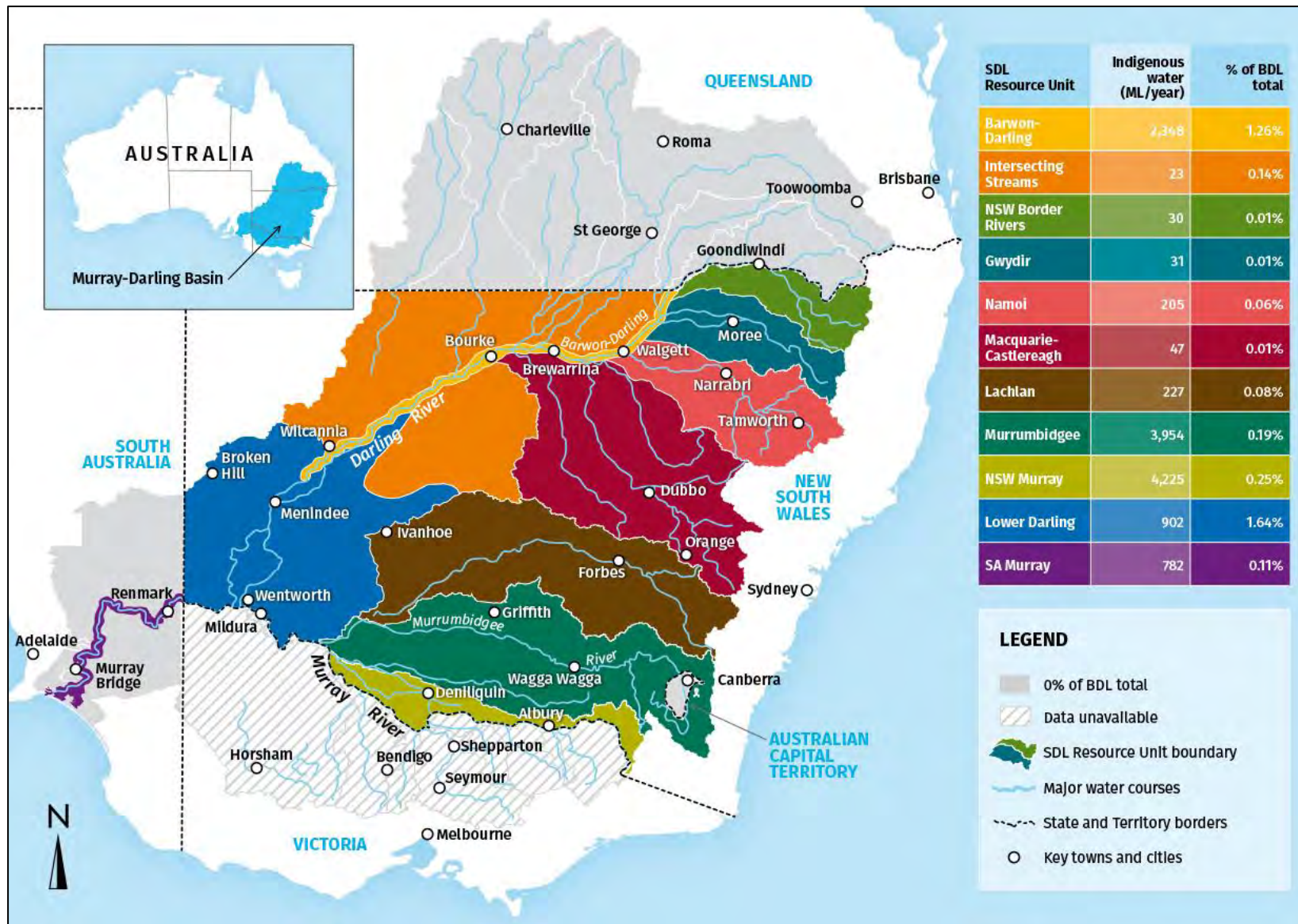


Figure 13: Distribution of Aboriginal water holdings and their share of total available water (BDL) per SDL resource unit

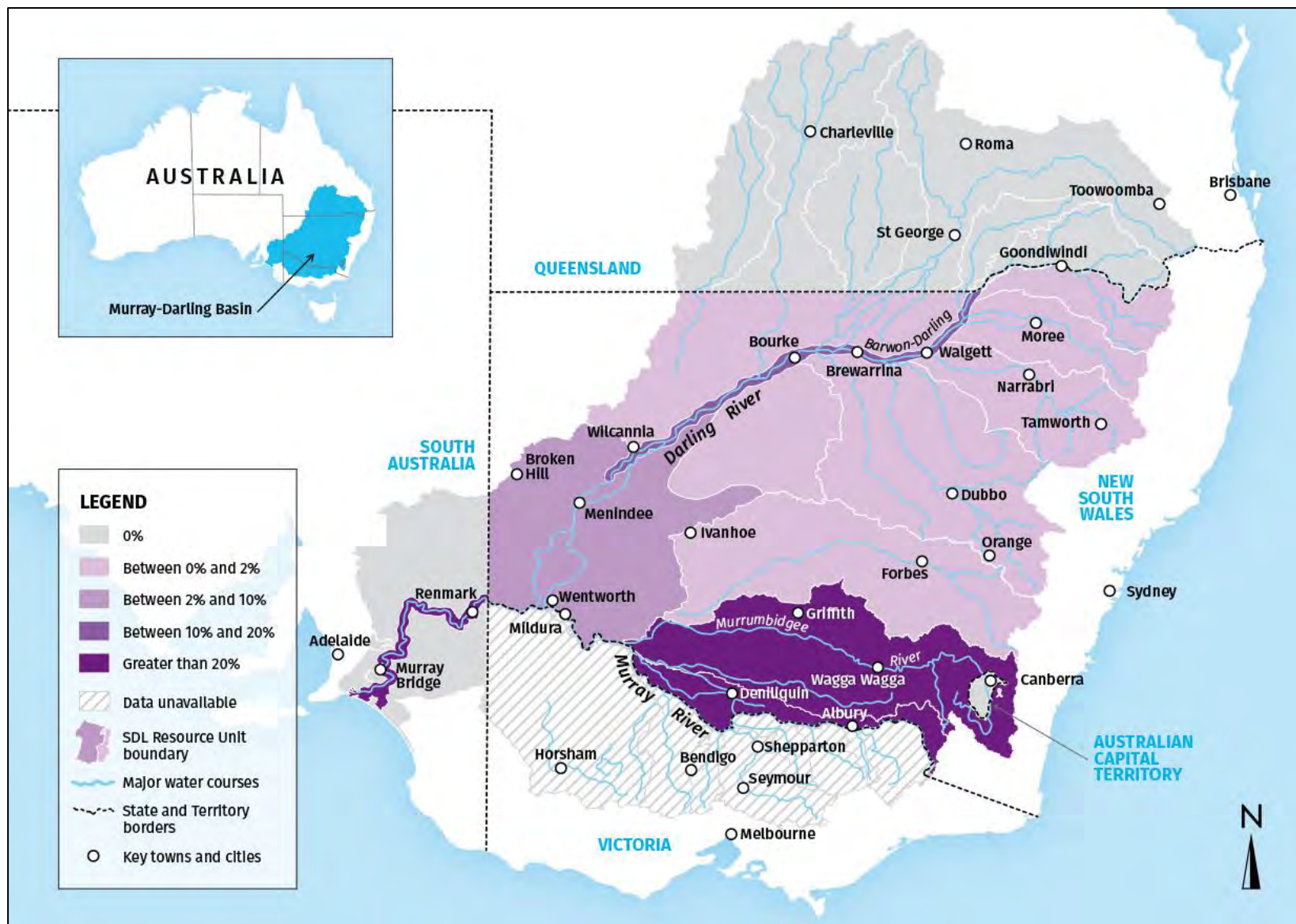


Figure 14: Spatial distribution of all Aboriginal water holdings by SDL resource unit, 2020

Reliability and security of Aboriginal water access and entitlement market value

Research indicates that entitlement reliability or security influences how licence holders plan for, use and benefit from their water entitlement/s (Peel, Schirmer & Mylek, 2016; Wheeler, Zuo & Hughes, 2014). Therefore, it is useful to consider and examine the different entitlement types held by Aboriginal entities in the 2020 baseline, and their relative reliability or security. Doing so provides insights into the regularity or certainty of water access Aboriginal peoples can benefit from as well as the economic value of their holdings. In this section, we examine the reliability and security of Aboriginal-held water entitlements, and then provide an estimate of their market value.

A complete list of entitlement types held by Aboriginal organisations is provided in Table 8.

Table 8: List of entitlement types held by Aboriginal organisations

Region	SDL resource unit	Entitlement types held by Aboriginal organisations
Northern Basin	Barwon-Darling	- Unregulated (A-Class) - Unregulated (B-Class)
	Intersecting Streams	- Domestic & Stock - Unregulated
	NSW Border Rivers	- Unregulated
	Gwydir	- Unregulated
	Namoi	- Domestic & Stock - General Security
	Macquarie-Castlereagh	- Domestic & Stock - General Security - High Security (Town Water Supply) - Supplementary - Unregulated
Southern Basin	Lachlan	- Domestic & Stock - General Security - High Security - Unregulated
	Murrumbidgee	- Domestic & Stock - General Security - High Security - Supplementary (Lowbidgee)
	NSW Murray	- Domestic & Stock - General Security - High Security - Supplementary - Unregulated
	Lower Darling	- General Security
	SA Murray	- Class 1 - Class 3 - Class 5

Note: Water sources not listed in the interest of confidentiality.

Unregulated and regulated entitlements

Across the Basin, 87% (by volume) of all surface water on issue is accessed through regulated entitlements, with the remaining 13% accessed through unregulated entitlements, based on 2018-19 data (BOM, 2020).³² Unregulated entitlements can offer less reliable water access and are more difficult to trade temporarily compared to regulated entitlements (Wheeler & Garrick, 2020). This is largely because these systems tend to have less regulating infrastructure to control and store water

³² Note that BOM (2020) data is based on nominal volumes while Aboriginal holdings use LTDLE volumes. No other more comparable data is currently available, and this still likely presents general

compared to more regulated water sources, because rules may more frequently limit or embargo extraction and/or trade, and because smaller volumes are on issue (Wheeler & Garrick, 2020).

Figure 15 below shows that Aboriginal entitles currently hold, and therefore access, water through a mixture of regulated (left hand side, 79%) and unregulated (right hand side, 20%)³³ water entitlements across the Northern Basin (dark blue, 21%) and the Southern Basin (light blue, 79%). Looking across the whole Basin, this image shows that most water held by Aboriginal entities is accessed via regulated entitlements (discussed in-depth below) within the Southern Basin. Less than 0.1% of Aboriginal-held water in the Southern Basin is accessed via unregulated entitlements. By comparison, only 5% of all surface water (by volume) on issue in the Southern Basin are unregulated, based on 2018-19 data (BOM, 2020).

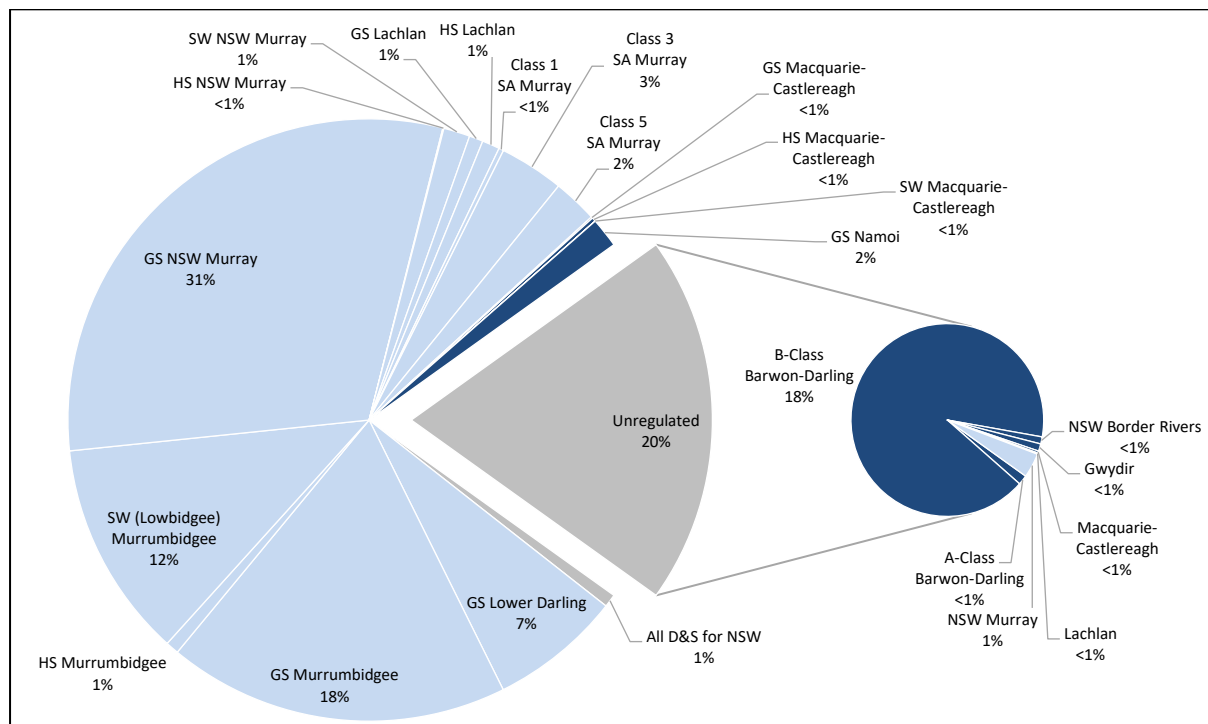


Figure 15: LTDLE Aboriginal water holdings by entitlement type, 2020

Notes: Lighter blue denotes Southern Basin entitlements, dark blue denotes Northern Basin entitlements, and grey denotes both. GS: General Security. HS: High Security. SW: Supplementary Water. D&S: Domestic & Stock. Specific water sources for Unregulated entitlements not listed in the interest of confidentiality.

This image also shows that the majority of water in the Northern Basin held by Aboriginal entities is accessed through unregulated entitlements (2,418 ML/y or 91%). This may be expected given the Southern Basin is more hydrologically connected than the Northern Basin. However, BOM (2020) data for 2018-19 shows that only 38% (by volume) of surface water on issue across the Northern Basin is accessed via unregulated entitlements. This means that Aboriginal entities hold disproportionately more water under unregulated entitlements not only across the whole Basin, but particularly in the Northern Basin, which, as noted, can be a less reliable means of accessing water and of lower market value.

Regulated entitlements

Second, we examine the reliability or security of water access under specifically *regulated* water entitlements. Many factors influence the reliability of regulated entitlements including regional

³³ All NSW Domestic & Stock entitlements are presented together, which constitutes approximately 0.7% of all Aboriginal-held water in the Basin.

water availability and water storage infrastructure. The Interim Inspector-General of MDB Water Resources (2020) reviews Basin States each have developed different approaches to water allocation, resulting in differences in the variability of water allocations from year to year. These differing overarching allocation frameworks partly explain some of the differences observed between individual States and Territories jurisdictions.

Comparing the reliability of different entitlements is difficult. Indeed, the Interim Inspector-General of MDB Water Resources' (2020) recent review of water shares across the Southern MDB found that there is "very little data available about long-term reliability of different entitlement types" (p. 21). That review also concluded that "there is a high likelihood that historical expectations of reliability are no longer accurate because climate conditions have changed," particularly for NSW General Security and Victorian Low Reliability water entitlements (Interim Inspector-General of MDB Water Resources, 2020, p. 21). These factors complicate reporting about the relative priority and reliability of Aboriginal held entitlements across the Basin. With these challenges in mind, the following discussion is indicative only, and focuses only on main types of regulated entitlements using water allocation data.³⁴

Water that is *allocated* to these regulated entitlements can actually be accessed and used (see Figure 4 earlier) by the entitlement holders or, following an allocation trade, by other users. Specifically, we used the average allocation per entitlement type at the close of the last 11 water years (from 2009-10 to 2019-20) to indicate the priority or reliability of different Aboriginal held entitlements.³⁵ Figure 16 presents the LTDLE volumes of Aboriginal-held water under these key regulated entitlement types, showing the indicative reliability of each entitlement. This figure shows that the majority (87.3%) of LTDLE Aboriginal-held water under regulated entitlements is of lower priority (those in orange). In other words, only a small number of Aboriginal organisations benefit from comparatively greater reliability and certainty of water access; the vast majority receive little such benefit. Further, much of the water that can be accessed through the more reliable entitlements can only be used for domestic and stock purposes.

³⁴ Supplementary regulated entitlements and unregulated entitlements are excluded because actual permitted water access through these arrangements is not easily identifiable or comparable to regulated entitlements. Supplementary entitlements tend to receive a 100% allocation at the beginning of each year, but actual water access is determined by Minister Announcements. Similarly, water entitlements for unregulated rivers and watercourses receive full allocations each water year but actual water access is dictated and determined based on river heights and/or flow thresholds. In both cases allocation information is not representative of actual water access.

³⁵ NSW data accessed from the NSW Water Register (<https://waterregister.watnsw.com.au/water-register-frame>). SA data supplied directly by SA DEW.

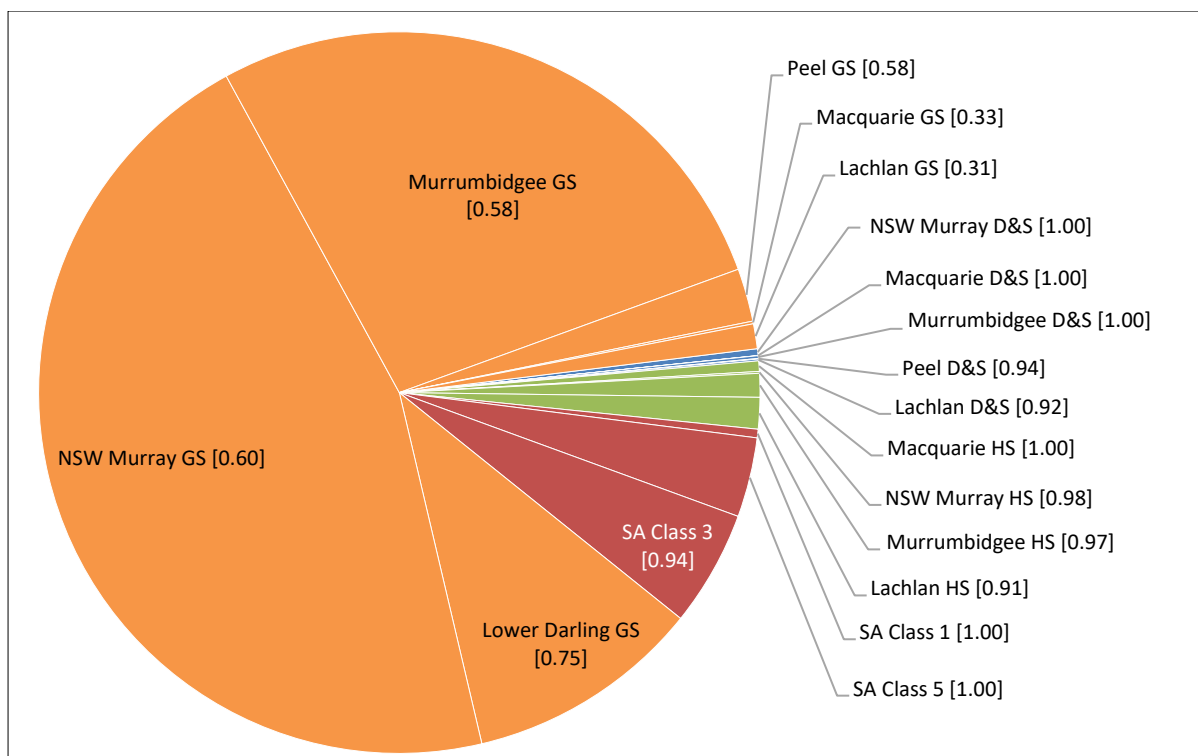


Figure 16: LTDLE Aboriginal-held water under regulated entitlements by entitlement reliability, 2020

Notes: Entitlement reliability is indicated using the entitlement allocation average at the close of water years from 2009-10 to 2019-20 and is presented in square brackets for each Aboriginal-held regulated entitlement type.³⁶ Allocation averages for Peel (in the Namoi SDL resource unit) are from only 2010-11 to 2019-20 based on data availability.

GS: General Security. HS: High Security. SW: Supplementary Water. D&S: Domestic & Stock.

Notably, all Aboriginal-held water entitlements in SA are more reliable than most other known Aboriginal-held entitlements in the Basin. This is reflective of the fact that all South Australian entitlements are more reliable than entitlements from other Basin states more generally. Of interest, SA River Murray Class 3 entitlements were recently renamed “Class 3 (High Security)” as this improves alignment “with similar products interstate, like New South Wales high security licences and Victorian high-reliability shares” (Natural Resources SA MDB, 2020).

In Victoria, we know from engaging with agency staff that Aboriginal entities hold water under both High Reliability and Low Reliability entitlements though it is not known in which valleys specifically these entitlements are located. Without this information, specific insights and analysis about the reliability of Victorian Aboriginal water holdings are not possible, but for interests’ sake, it is worth briefly considering how some of these entitlements compare with those listed in Figure 16. Historically, Victorian Low Reliability entitlements receive water allocations less than NSW General Security entitlement and in recent years, this is due to Victoria’s more conservative approach to seasonal water allocation as well as less water availability (Interim Inspector-General of MDB Water Resources, 2020). Victorian High Reliability (HR) entitlements have far greater certainty of access than Low Reliability options, with water allocation averages ranging from 0.78 (Ovens HR) to 1 (Vic Murray HR) (NVRM, 2020). These indicators of access reliability compare with some of NSW General Security entitlements and higher from Figure 16.

³⁶ It is necessary to clarify the difference between water allocation and LTDLE factors, especially as both are indicated by a value between 0 and 1. Put simply, water allocations are measures of *actually available* water that can be (though is not always) used by entitlement holders. These measures are informed by climatic and water storage conditions at specific times. By contrast, LTDLE factors reflect *average* long-term water *use* trends and are representative only. Long-term average water allocation data (calculated using modelling) is an input in determining LTDLE factors.

We see there are two key observations from reviewing the entitlements types of Aboriginal water holdings. First, Aboriginal water access through unregulated entitlements is disproportionately higher than all water holdings at both the whole Basin and the Northern Basin scales. Second, the majority of Aboriginal water access through regulated entitlements occurs through comparatively less reliable or secure entitlements which are, perhaps, of less market value. These conditions likely affect how Aboriginal entities can use and benefit from their water. In some cases, it may negatively affect their ability for longer-term planning associated with water use (see Peel et al., 2016; Wheeler et al., 2014b). This is only likely to worsen with a drying climate and the associated implications for water availability and access (Interim Inspector-General of MDB Water Resources, 2020).³⁷

Market value estimate

There are multiple water valuation methodologies (see Seidl, Wheeler & Zuo, 2020) as well as variations in water pricing and sales that, together, make estimating and comparing market values difficult. That is, the dollar value of 1 ML of water in both the entitlement and allocation markets differs across water sources and based on total sale volume, due to regional differences in supply versus demand. In what follows, we present market valuations as estimates only, but believe them to be reasonable and justifiable given the available data. For clarity and transparency, we detail the method used for this valuation in Appendix F.

We estimate the market value of Aboriginal water holdings in the MDB to be approximately \$18.4 million in 2015-16 water market terms. These holdings constitute just 0.11% of the MDB’s \$16.5 billion water market (in 2015-16 terms) (ABARES, 2018a). The proportional contribution of different water entitlement types towards this total market value is presented in Figure 17. We estimate Aboriginal-held water entitlements in the Southern Basin to be worth \$15.3 million. We estimate Aboriginal-held water entitlements in the Northern Basin to be worth \$3.1 million. Across the Basin, we estimate Aboriginal-held unregulated water entitlements are valued at about \$1.8 million.³⁸

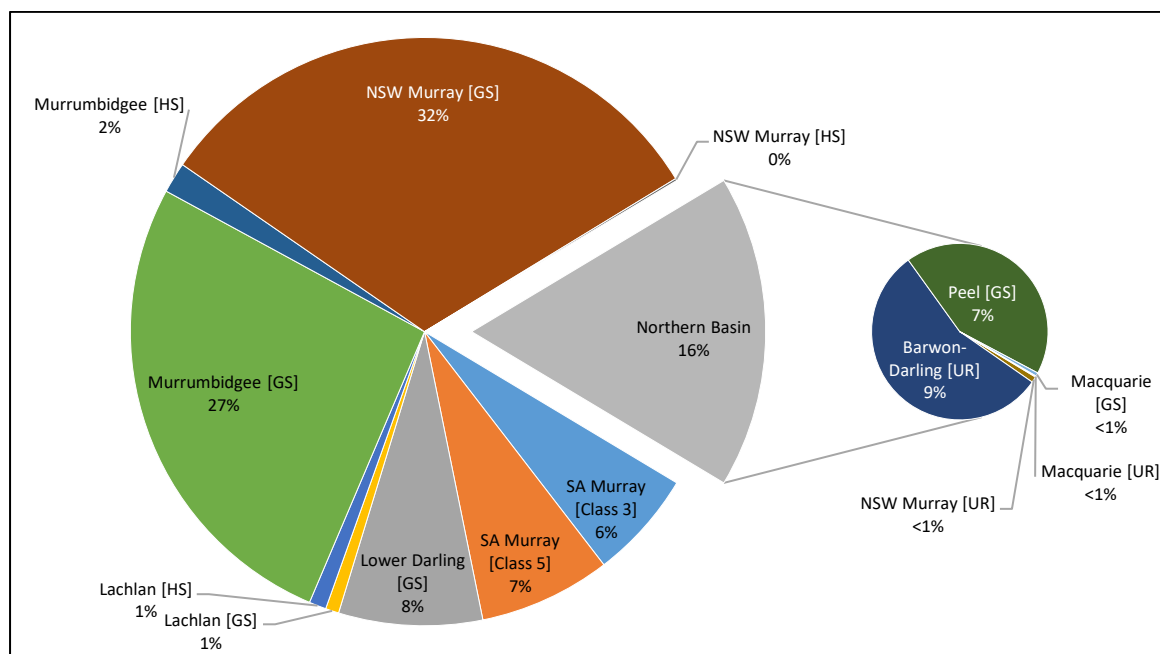


Figure 17: 2020 Aboriginal surface water holdings by estimated market value in 2015-16 market terms
 GS: General Security. HS: High Security. SW: Supplementary Water. D&S: Domestic & Stock. UR: Unregulated. Specific water sources for unregulated entitlements are not listed in the interest of confidentiality.

³⁷ We have not considered any influence or impact of carry over for different entitlements in this analysis and discussion.

³⁸ Valuation estimates for unregulated and Northern Basin entitlements have a higher degree of uncertainty. See Appendix F.

Of note, water held under NSW Murray and Murrumbidgee GS water entitlements constitutes over half (57%) of all market value of Aboriginal water holdings. This is somewhat expected given water entitlement volumes and LTDLE volumes are largest for these entitlement types, as shown in Figure 18. Note that only entitlement types for which a market value can be provided using the method described in Appendix F are presented in Figure 17 and Figure 18.

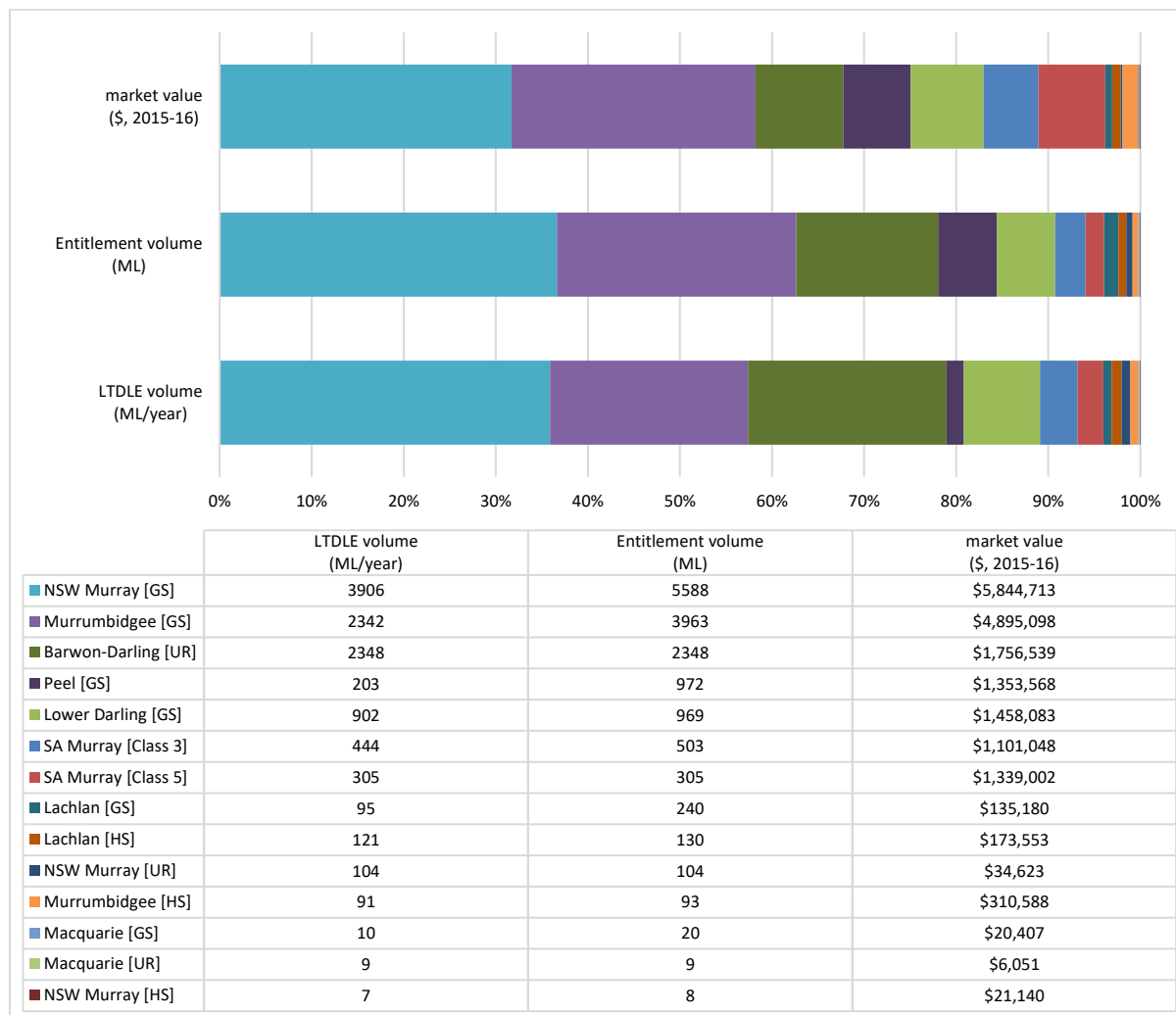


Figure 18: 2020 Aboriginal water holdings by LTDLE volume, entitlement volume and market value (in 2015-16 terms)

Note: Specific water sources for unregulated entitlements are not listed in the interest of confidentiality.

Water recovered for the environment and Aboriginal-held water

In Table 9, we present Aboriginal water holdings alongside water that governments have recovered for the environment from comparable takes (as at 31 March 2020).³⁹ This shows that governments have recovered some 19.3% of LTDLE water under entitlement for the environment. This volume of water is sizeable—more than 150 times that currently held by Aboriginal entities.

Growing evidence suggests that environmental water management and delivery can benefit First Nations across the Basin, particularly where First Nations are involved in some capacity (Jackson & Nias, 2019; Mooney & Cullen, 2019; Weir, 2009). In principle, this volume of water presents significant potential for pursuing and delivering co-benefits for both the environment and First

³⁹ The exception here is the Condamine-Balonne SDL resource unit in Queensland, where it is understood that water recovery is associated with take by floodplain harvesting (Carol Bruce, Assistant Director, Surface Water, SDL Accounting & Aboriginal Partnerships Branch, MDBA, *pers comm*, 6 May 2020).

Nations peoples across the Basin. However, this is a very complex and nuanced area of water planning and policy. More research and deliberation with First Nations peoples is needed to understand and explore the array of outcomes from the co-management of environmental water more fully.⁴⁰ We note that the recent policy shift that rules out further buy backs (DAWR, 2020) may have implications here.

Table 9: Aboriginal-held water and water recovered by governments for the environment

Area	Aboriginal- held water (2020)		Water recovered for the environment (31-Mar-2020)	
	LTDLE (GL/y)	share of the BDL for the area (%)	LTDLE (GL/y)	share of the BDL for the area (%)
Queensland*	0	0	127.1	13.3
NSW	11.992	0.21	1,004.6	17.8
ACT	0	0	0	0
Victoria	<i>Data unavailable</i>		825.6	23.2
South Australia	0.782	0.11	141.0	20.2
Northern Basin total	2.911	0.11	381	14.0
Southern Basin (inc Vic) total	9.863	0.12	1,718	21.0
Southern Basin (exc Vic) total	9.863	0.21	892	19.3
Total Basin (inc Vic)	12.774	0.12	2,098	19.3
Total Basin (exc Vic)	12.774	0.17	1,273	17.3

Source: Environmental water recovered from MDBA (2020b)

Note: *Condamine-Balonne SDL resource unit in Queensland, where water recovery is associated with take by floodplain harvesting.

Some legislative and policy work is underway to enhance and broaden these benefits and outcomes from environmental water for Aboriginal peoples. This includes collaborative projects in the Northern and Southern Basins that aim to identify and incorporate First Nations' priorities into annual and long-term environmental watering activities (Select Committee on the Multi-Jurisdictional Management and Execution of the Murray Darling Basin Plan, 2019).⁴¹ From 2019, the MDBA must also "annually report on how, when planning for environmental watering, holders of held environmental water considered Indigenous values and Indigenous uses and involved Indigenous people" (Select Committee on the Multi-Jurisdictional Management and Execution of the Murray Darling Basin Plan, 2019, p. 59).

First Nations aspire to use water for commercial gain. Therefore, developing and further understanding First Nations' benefits from environmental watering should not occur at the expense of reallocating water to First Nations—*both* require development.

Aboriginal water holdings as a portion of SDL

As mentioned, the Basin Plan requires that surface water diversions be reduced from BDLs to SDLs, meaning that in the future, consumptive water use in each valley will be allowed up to the SDL (SA DEW, 2019). As such, SDLs will become the new benchmark for future analyses and comparisons.⁴² Therefore, it is worth considering Aboriginal-held water entitlements as a proportion of not only the

⁴⁰ Importantly, environmental watering does not automatically satisfy, nor can it be a substitute for, Aboriginal watering objectives and priorities.

⁴¹ In the Northern Basin, the MDBA is working with NBAN on the First Nations Environmental Water Guidance Project. In the Southern Basin, the MDBA and the Commonwealth Environmental Water Office are working with MLDRIN on the First Nations' Environmental Water Objectives Project.

⁴² Noting that SDL values and LTDLE factors may alter slightly as better information becomes available. See Appendix E.

equivalent and comparable BDL as we have so far, but also the equivalent and comparable SDL, as presented in Table 10. As expected, Aboriginal water holdings constitute a slightly larger proportion of SDL compared to the larger BDL extraction limit, but these proportions remain extremely small.

Table 10: Aboriginal water holdings as portion of equivalent and comparable BDLs and SDLs, early 2020

Area	LTDLE water held (GL/y)	Share of the BDL for the area (%)	Share of the SDL for the area (%)
Queensland	0	0	0
NSW	11.992	0.21	0.27
ACT	0	0	0
Victoria	Data unavailable	Data unavailable	Data unavailable
South Australia	0.782	0.11	0.14
Northern Basin total	2.911	0.11	0.12
Southern Basin (inc Vic) total	9.863	0.12	0.16
Southern Basin (exc Vic) total	9.863	0.21	0.28
Total Basin (inc Vic)	12.774	0.12	0.15
Total Basin (exc Vic)	12.774	0.17	0.22

Note: BDL and SDL data is determined using only equivalent takes (i.e. “take from a regulated river” and “take from a watercourse”) and based on 2019/20 water year estimates (MDBA, 2019c, 2019d).

Aboriginal water holdings: Groundwater

We now describe Aboriginal-held groundwater entitlements across the MDB. Overall, very few such entitlements were identified but several observations warrant attention. Indeed, so few were identified that, in the interest of confidentiality, Appendix C presents Aboriginal groundwater holding data for the WRP area, State Basin portion and overall Basin scales, but not the SDL resource unit level.

Spatial distribution, character of entitlements and change over time

Across the groundwater sources in the MDB, we found six⁴³ entitlements held by six Aboriginal entities in 2020. These entitlements total 556 ML, with individual entitlements ranging from 19 ML to 240 ML. These Aboriginal-held groundwater entitlements constitute 0.022% of the available groundwater resource in the Basin States (excluding Victoria), or 0.027% of the available groundwater resource of the whole Basin. Drawing on anecdotal evidence about Aboriginal water holdings in the Victorian portion of the Basin (including conversations with Victorian agency staff and ACCC (2020)), we anticipate that Aboriginal water holdings could, at a generous estimate, constitute up to 0.03% of the whole Basin’s available water.

No Aboriginal-held groundwater entitlements were located in Queensland, ACT, and South Australia. All six relate to aquifers in NSW in six different SDL resource units across four WRP areas. Table 11 below lists Aboriginal-held groundwater information for these four WRP areas. No Aboriginal water holdings exist in the remaining seven NSW WRP areas, as shown in Appendix C.

⁴³ While Aboriginal water holdings in Victoria are uncouncted, there is a possibility of a greater number.

Table 11: WRP areas where Aboriginal entities hold groundwater entitlements

WRP area	Aboriginal groundwater entitlements (ML)	Comparable volume of Aboriginal groundwater entitlements (ML)	Comparable volume of Aboriginal groundwater entitlements as a share of available groundwater resource (%)
Lachlan Alluvium*	59	42	0.020
NSW Murray-Darling Fractured Rock	240	240	0.105
Macquarie-Castlereagh Alluvium*	39	29	0.036
Namoi Alluvium*	218	182	0.081

Note: *denotes WRP areas with a comparison ratio of less than 1.

At a scale higher, Aboriginal-held groundwater (0.556 GL) compared with the available groundwater source across the whole NSW-MDB (1,659 GL), is 0.034%. We estimate that these Aboriginal-held groundwater entitlements are valued at approximately A\$772,800 (in 2015-16 terms), which equates to about 0.005% of the market value of all groundwater entitlements in the MDB in 2015-16.

As already noted, most groundwater entitlements across the Basin receive full (i.e. 100%) allocations most water years. Indeed, the six groundwater entitlement types held by Aboriginal entities have received 100% allocations at the beginning of every water year on record,⁴⁴ with the exception of one entitlement in one year (2019-20). Evidently, the reliability of groundwater entitlement types held by Aboriginal entities are relatively comparable and it is not necessary to use high allocation as an indicator of entitlement security or reliability (as we did for surface water).

Anecdotal evidence suggests that NSW Aboriginal organisations acquired these groundwater entitlements in the same ways that surface water entitlements were initially acquired; combined with land transfers, under State or Federal land rights regimes. Four of these Aboriginal organisations are Local Aboriginal Land Councils, three of which hold surface water entitlements. The remaining two are Aboriginal corporations, of which one has a surface water entitlement.

The unique Indigenous-specific water entitlements available in NSW (discussed earlier with respect to surface water) could conceivably exist for groundwater sources. This is made possible through NSW's Water Sharing Plans.⁴⁵ At this time, however, none were identified within NSW-MDB groundwater sources.

We acknowledge that Altman and Arthur (2009) identified more than six entitlements in NSW MDB groundwater sources. We classify this apparent reduction over time into two categories. First, at the time their baseline was developed, some groundwater entitlements were still under the former *Water Act 1912* (NSW) framework and had not been converted to current aquifer water access licences under the *Water Management Act 2000* (NSW). This conversion occurred upon commencement of a Water Sharing Plan (NSW Department of Primary Industries, 2015). Many of the groundwater entitlements that Altman and Arthur (2009) identified were without volumes. Searching the NSW Water Register reveals these entitlements were not converted. This is because the water access permitted under the former licensing framework was for stock and/or domestic purposes, and under the new regime this is considered a basic landholder right and therefore an

⁴⁴ On record means since converted to WALs under the *Water Management Act 2000* (NSW).

⁴⁵ For example, outside of the MDB, at least one such entitlement exists in the Dorrigo Basalt Groundwater source.

entitlement to take water is no longer required (s 52, *Water Management Act 2000*) (see also NSW Department of Primary Industries, 2015). Therefore, this apparent decline in the number of entitlements does not appear to represent a decline in Aboriginal organisations' access to groundwater resources.

By contrast, the second category of loss is permanent sales or transfers, which *does* constitute a loss of access. Specifically, through the NSW Water Register, we traced the permanent transfer of 169 ML of ongoing water rights held under aquifer entitlements away from Aboriginal ownership between 2009 and 2020. This constitutes a 23.3% decline Basin-wide of Aboriginal groundwater holdings since 2009. Reasons for these changes (declines) among aquifer holdings are unknown and require further investigation.

5. Discussion, research recommendations and policy implications

The Indigenous population baseline and analysis presented in this report reveals the following key findings:

- the MDB is home to more than 120,000 Indigenous persons (15.1% of all Indigenous Australians nationally), who represent 5.3% of the total MDB population;
- in some regions and townships (particularly northern and western NSW), Indigenous peoples constitute significant proportions of the total population; and,
- the MDB Indigenous population is growing considerably faster than the non-Indigenous population.

Our 2020 baseline reveals that Aboriginal organisations hold at least 12.774 GL/y of surface water and that this is not likely to exceed 0.17% of all surface water holdings across the Basin. Using LTDLE volumes as a measure of water access, we can conclude that Aboriginal entities have greater surface water access in the Southern Basin (79.0%) than the Northern Basin (21.0%). The severity of the inequity in water distribution is apparent when we consider that 61.7% of the Indigenous population in the Basin (excluding Victoria) live in this Northern Basin area. In this same area, Aboriginal entities hold rights to a smaller proportion of available surface water, under entitlements with access conditions that are generally less secure or reliable.

The 2020 baseline reveals that Aboriginal organisations hold even less groundwater, with entitlements totalling 0.556 GL, which equates to 0.022% of the available groundwater resource across the whole Basin. We cannot combine this volume with the total Aboriginal surface water holdings because of differences in water accounting methods for surface water and groundwater.

NSW has the majority of Aboriginal held water entitlements (both surface water and groundwater). South Australian Aboriginal entities hold some surface water entitlements in the Basin, but no groundwater entitlements. No water entitlements of either kind were found to be held by Aboriginal entities in Queensland or the ACT. In 2015-16 terms, we estimate Aboriginal-held surface water entitlements are valued at approximately \$18.4 million, while Aboriginal-held groundwater entitlements are valued at approximately \$772,800. The approximate total market value of these entitlements is A\$19.2 million in 2015-16 terms, which equates to 0.12% of the total market value of all MDB entitlements in that water year (ABARES, 2018a).

In what follows, we present a series of research and policy recommendations based on these findings and comment on the limitations of this research. Where possible, we emphasise the relevance and importance of these observations and recommendations for the MDBA based on its legislative functions, including those relating to the Basin Plan. However, these recommendations and reflections are also of relevance to MLDRIN, NBAN, Basin States and Territories, and assorted government departments and entities such as the Department of Agriculture, Water and the Environment, and the ILSC.

Future demographic, socio-economic and water research

The MDBA, along with the Department of Agriculture, Water and the Environment, have produced and/or commissioned an array of population-wide socio-economic studies (see, for example, MDBA, 2017b; Schirmer, 2017; Schirmer & Mylek, 2020) and regional profiles across the Northern and Southern Basins (MDBA, 2018c) in recent years. However, these and other analyses present very little Indigenous-specific socioeconomic and demographic data (see also Marden Jacobs, 2019). This

can mask profound and distinct socioeconomic and disadvantage differences between Indigenous and non-Indigenous populations in the Basin (ABS et al., 2009; Schirmer & Mylek, 2020; Taylor & Biddle, 2004). By extension, it can also mask different experiences of and impacts from the Basin Plan, water recovery, and water reform more broadly (Marsden Jacobs, 2019).

The MDBA is responsible for implementing and monitoring the Basin Plan, including progress relating to its objectives and outcomes. The Basin Plan includes overall objectives such as optimising social, economic, and environmental outcomes arising from the use of Basin water resources in the national interest and improving water security for all uses of Basin water resources (cl 5.02). Its overall intended outcome is a healthy and working Murray-Darling Basin, which includes (a) communities with sufficient and reliable water supplies that are fit for a range of intended purposes, including domestic, recreational and cultural uses; and (b) productive and resilient water-dependent industries, and communities with confidence in their long-term future (cl 5.02). Measuring or monitoring progress against the objectives and outcomes relating to Indigenous peoples is difficult if baseline information is incomplete, inadequate, or non-existent.

To address this gap, we therefore recommend that the MDBA undertake further demographic and socio-economic baselining research to supplement the Indigenous population baseline data presented in this report. Having Aboriginal people drive the development of socioeconomic and demographic baselines will help to overcome some of the noted limitations of Census and other administrative counts (see Section 3), and enable First Nations peoples to express their collective identities on their terms that move beyond conventional government-determined categories and classifications (Taylor, 2011; Walter, 2018). We recommend that such a program consider the whole Basin as well as smaller water management units, as we have in this report.

Such a program could include:

- Indigenous and non-Indigenous population-focused data, including populations by localities, settlements, townships, and classifications of remoteness, as well as population change and migration, population age and sex structure, and future population projections;
- socio-economic and demographic characteristics including workforce and labour status including industry and occupation data, business ownership, income, particularly where land and water are involved; and,
- socioeconomic and wellbeing activities and outcomes that stem directly and indirectly from holding and/or managing land and water.

The baselines developed in this report provide much-needed information for the latter area of research. We understand that the MDBA has commissioned other relevant work here too, in part in response to recommendations from the recent Independent the Assessment of Social and Economic Conditions in the MDB (see Sefton et al., 2020).

A concerted focus on the benefits and impacts for First Nations from environmental watering projects and actions and monitoring of these is also needed. In particular, we recommend that the MDBA, and State and Territory agencies build upon their existing arrangements to further centre and prioritise First Nations' voices and participation in environmental watering. We stress, though, that such actions should *complement*, not be a substitute for, the redistribution of water to Aboriginal people for direct economic benefit, for which we provide recommendations later.

Insights generated through the profiling and analysis approach described here can inform and build First Nations' governance and capacity (Taylor & Biddle, 2004; Walter, 2018). It can also inform land

and water policies and ambitions of First Nations, shape sensitive planning and policy development that is responsive to their needs, and support and provide important benchmarks for use in future monitoring and evaluation.

State water registers and reporting

We encountered several challenges relating to state water registers, water reporting and water accounting. While these are relevant for State and Territory governments, they are also significant for the MDBA. This is because the Basin Plan includes an objective to “minimise transaction cost on water trades, *including through good information flows in the market and compatible entitlement, registry, regulatory and other arrangements across jurisdictions*” (cl 5.07(1)(b), emphasis added). Additionally, the MDBA may request State and Territory governments to carry out any measuring, monitoring, or recording within their geographical limits that the Authority considers necessary (*Water Act 2007* (Cth), s 172(2)). Therefore, we recommend that both the MDBA, as well as State and Territory governments, address the points raised here to enhance the accuracy of insights into Aboriginal-held water entitlements.

We note that the ACCC’s current inquiry into water markets in the MDB is examining some of the water register and reporting points that we include here (see ACCC, 2020). It is important that our observations are considered alongside the findings and recommendations from this inquiry.

The first set of issues pertains to State and Territory water registers. Alongside issues with the accuracy of the information recorded and reported in these registers, Seidl et al. (2020) recently observed that:

in contrast to land registers, water ownership registers are not accessible publicly. Individual water licence information is often behind a pay-per-record paywall, making it difficult to discern the size and value of various water holdings. This is complicated by the fact that authorities often require stakeholders’ permission to share water licence information, even in case of paid requests. (p. 4).

The first type of challenge we observed from using the registers was the inter-jurisdictional differences. This included, but was not limited to, differences in search options, search prices, and in the information provided in search results. The challenge of navigating and understanding the different water entitlement and licencing regimes in each jurisdiction and their different searching interfaces poses an additional challenge.

The second issue was the tension between privacy requirements and rigorous search capabilities. As noted in Section 3, allowing name-based searches, as is possible in NSW and Queensland, means that the searcher can have less information to begin with. Where this is not possible, as in Victoria and SA, searchers are required to have a threshold level of information (i.e. water entitlement numbers) before any searching can occur. Assuming you have an unlimited budget, the former option facilitates more rigorous searching and is more likely to generate a more comprehensive baseline. In conducting research and inquiries that contributed to this report, we found some stakeholders (such as some Basin State Governments and some First Nations organisations) appreciated this level of transparency, while others were opposed to it, citing privacy and confidentiality reasons. Recognising that there are different preferences and positions on these issues is important.

A third problem arose when using water register searches to identify and track historical change. Of the Basin jurisdictions, only NSW water registers offer some capacity to track past water holding

changes and transfers, in that name-based searches yield current and previously held water entitlement information. However, the utility of this capacity is constrained by several features:

- Limited history: Only water entitlements issued under the *Water Management Act 2000* arrangement are included. NSW issued these entitlements in a staggered approach, beginning in July 2004 for most major regulated rivers and finishing for all remaining surface water systems in the Basin in October 2012.⁴⁶
- Cancelled entitlements: Some cancelled entitlements no longer appear on the register while others do. Some data may be attained if the entitlement reference number (different to the entitlement number) is known, and the information broker and/or State registry consultant is helpful.

In other words, it is difficult to identify (previously) Aboriginal-held entitlements that are now cancelled, especially where (a) they were transferred from Aboriginal-ownership prior to the current legislative arrangements and (b) the entitlement was not previously identified (i.e. such as in Altman & Arthur's 2009 baseline).

Future monitoring of Aboriginal water holdings will be difficult and/or weakened without systematic and reliable means to accurately trace water entitlement transfers and cancellations. Indeed, the complete lack of capacity to search for historical water holdings and transfers in public water registers in most jurisdictions undermined our ability to identify and describe changes to Aboriginal water holdings over the last 10 years in much detail. Changes were reported where possible based on the only other benchmarking of Aboriginal water holdings across Australia (Altman & Arthur, 2009).

We make several recommendations in light of these water register issues. First, stakeholders (especially representatives from relevant Federal and State agencies) would benefit from a facilitated discussion about their goals and priorities regarding these search functions. Second, it could be worth reviewing different jurisdictions' privacy requirements to gain a better understanding of why such diverse arrangements are in place. Third, we encourage government agencies to develop cooperative and innovative approaches and agreements to share information, especially where this is likely to contribute to greater First Nation involvement and advancement in water reform, while simultaneously upholding important privacy and confidential legal requirements and other obligations on the other. Fourth, water registers should consider tracking and reporting water title transfers, akin to land titles, including where those water holdings have been cancelled.

There are other water reporting and accounting inconsistencies and challenges. We have noted already the lack of consistent information about long-term water allocations, and how this can undermine descriptions and comparisons of the reliability and security of different water entitlements across the Basin (Interim Inspector-General of MDB Water Resources, 2020). Should further research into the comparative reliability of different water entitlement types be developed in response to the Interim Inspector-General's (2020) findings, we recommend that the implications for Aboriginal water access be examined.

Adding to this is the diverse water valuation methods used by different practitioners across the Basin (and a scarcity of information about those methods). No state water registers report water valuations, only the sale price that individual sales yielded but these too are frequently erroneous (Seidl et al., 2020). Because of these issues, we reiterate that the market valuations provided in this

⁴⁶ Entitlements under the former *Water Act 1912* (NSW) are not included. For land, properties held after 1 June 1971 are listed.

report are indicative estimates only. Paying attention to and addressing these issues could help to improve the accuracy of future analyses of Aboriginal water holdings and their market value.

Furthermore, to aid and improve the accuracy of future Aboriginal water baselining exercises, LTDLE factors—or some other, alternative mechanisms—should be developed for all entitlement types to facilitate comparison across *all* different entitlements, not just those that have been recovered by governments for the environment. This should include unregulated entitlements and groundwater entitlements. Moreover, as new and improved information and modelling continue to come to light and efficiency projects continue to be developed, it is likely that surface water LTDLE factors, BDLs and SDLs values may change through to 2024 (MDBA, 2020a). Future Aboriginal water holdings assessments should pay attention to and account for these slight changes when comparing results with those presented in this report.

Water redistribution policies and programs

Given that Australian governments committed to improving Aboriginal water access under national policy in 2004, the findings of this report demand urgent attention and policy redress. Although the MDBA itself does not issue water entitlements, it is charged with supporting, encouraging and conducting research and investigations about the Basin water resources, including the equitable, efficient and sustainable use of Basin water resources and developing, or assisting the development of measures that help to achieve this (*Water Act 2007* (Cth) s 172(1)). We hope that State and Territory governments will act on these recommendations.

Policy discussions and programs which aim to reallocate water to Aboriginal peoples are under development in the MDB at both the Federal and (some) State and Territory scales. For example:

- In 2018, the Australian Government committed A\$40million to purchase water entitlements for cultural and economic uses for MDB Aboriginal communities as part of Basin Plan negotiations (DAWR, 2018) (discussed more below).
- In 2016, the Victorian Government committed to investing A\$5million and working in partnership with TOs to “develop a roadmap for access to water for economic development” (Victoria DELWP, 2016).
- In late 2018, legislative changes expanded the Indigenous Land Corporation’s (ILC) remit from only land-related support to now include supporting and funding water-related projects too (ILSC, 2018).
- The Queensland Government has committed to develop a process for granting water entitlements for currently unallocated water reserves to First Nations for any purpose (DNRME, 2019).

While no water has yet been reallocated to Aboriginal peoples inside the MDB through these policies,⁴⁷ it is clear that they will be difficult to implement if such reallocations were to impact upon existing water users’ rights and entitlements (National Irrigators’ Council, 2017; Productivity Commission, 2017). The water market provides a potential mechanism to ensure this (Macpherson; 2019; McAvoy, 2006; Productivity Commission, 2017) and recent research has indicated public support for this kind of water redistribution to Aboriginal peoples (Jackson et al., 2019). That study surveyed households from the jurisdictions of the MDB and found that 69.2% of respondents

⁴⁷ In November 2020, the Victorian Government handed back 2 GL water entitlement to the Gunaikurnai Land and Waters Aboriginal Corporation in south-eastern Victoria (see McDonald & O’Donnell, 2020).

support the principle of reallocating a small amount of water from irrigators to Aboriginal people via the water market (Jackson et al., 2019).

Undoubtedly, the financial costs of securing water entitlements on the market for Aboriginal peoples is expected to be significant (Behrendt & Thompson, 2004; Downey & Clune, 2020; Jackson & Langton, 2012; Jackson & Morrison, 2007; McAvoy 2006; 2008). The significance of this is revealed in the fact that the Australian Government's A\$40 million commitment to purchase water for Aboriginal people for economic and cultural purposes equates to just 0.2% of the market value of all entitlements in the MDB (in 2015-16 terms). Assuming that there are no changes to the Aboriginal water holdings we document here (worth A\$19.2 million), and that all A\$40 million is spent only on additional water entitlements, with no administration or other costs (we will come back to this shortly); this expenditure would see Aboriginal water holdings more than triple in value to A\$58.4 million. While this seems like a significant increase, Aboriginal water holdings would still only constitute 0.35% of the market value of all entitlements in the MDB (in 2015-16 terms).

However, several issues need further consideration when making these crude estimates. First, as previously mentioned, current Aboriginal water holdings are disproportionately unregulated and less reliable than other water holdings. In determining which water entitlements should be purchased for First Nations, the reliability and security of the entitlements needs to be considered alongside Aboriginal peoples' water use preferences and goals.

Second, the value of the MDB water market is appreciating over time (Aither, 2019; BOM, 2020; Seidl et al., 2020).⁴⁸ This means that less water will be recoverable with the \$40 million compared to May 2018 when the funds were pledged. The longer purchasing action is delayed, the smaller the volume of water that can likely be purchased and/or at lower security.

Third, any policies or programs aimed at facilitating Aboriginal self-determination regarding water and its use must be comprehensive and address more than only water rights acquisition. Other such matters include, but are not limited to, costs from administering and distributing the funding, transaction fees in the acquisition transactions, ongoing licencing fees and usages fees, and infrastructure acquisition and maintenance costs. Factors relating to land access and use are also inseparable from water access matters (see Hartwig et al., 2020; In review). Further, capacity, resourcing and support that are tailored to Aboriginal water use preferences are needed, as is investment in Aboriginal peoples' water (market) literacy. The importance of addressing *all* these aspects is emphasised when we recall that Hartwig et al. (2020) found a 17.2% decline in Aboriginal water holdings in the NSW portion of the MDB between 2009 and 2018, largely due to liquidation of Aboriginal organisations. Governments should collectively make every effort to prevent further declines in Aboriginal water holdings.

In a system like the MDB, where most surface water systems are fully allocated, groundwater may present a possible option for increasing Aboriginal water access, use, and engagement in water trading. Many groundwater sources across the Basin are not fully committed, meaning they have capacity for additional volumetric water entitlements to be issued potentially at a lesser cost than buying surface water entitlements on the open water market. Groundwater access is not dependent on river frontage or access to irrigation channels and so may be more accessible for more Aboriginal landholders, wherever they may exist.

⁴⁸ For example, the total market value of all entitlements on issue is likely much larger than \$16.5 billion given that Aither (2019) estimated the total market value of only the 11 "major" surface water entitlements in 2018/19 in the Southern Basin at approximately \$22.7 billion.

Several significant caveats, however, accompany this observation. First, any such approach needs to account for First Nations' perspectives and priorities about further development of and extraction from groundwater and aquifer sources. For example, evidence from 2017 consultation with First Nations about proposed amendments to increase SDLs for some groundwater sources,⁴⁹ as well as literature (see Moggridge, 2020), indicates that this option may not be widely supported. Aboriginal ownership of groundwater entitlements does not necessarily mean that water has to be extracted or traded, though. In fact, holding entitlements to groundwater (or, indeed, surface water) may be a means to protect water from extraction by others and may be supported by First Nations.

In addition, institutional, physical, and location-specific factors may complicate or undermine the feasibility of Aboriginal communities using and benefiting from using (i.e. extracting) groundwater. First, to be eligible to access and benefit from groundwater, Aboriginal people must hold, or have legal access to, land. Hartwig et al. (In review) show that Aboriginal landholdings in the MDB are still extremely small, at least in the NSW portion where they are less than 1% of the land area. Low rates of Aboriginal land ownership may undermine this potential means of improving access. Second, although new access entitlements to groundwater sources may be more promising hypothetically, not *all* aquifers have unassigned or available water. If Aboriginal-held land is located above a fully assigned groundwater source, then an entitlement could be acquired only via the open market.

Third, should the above conditions be met, installation of a bore may be required, which can cost \$10,000-\$15,000 or more, depending on the depth required (and other factors). Fourth, accessing and extracting water from aquifers can be expensive, even after a bore is installed. Reasons for this are varied and location specific, but may include difficulties in pumping and accessing, lower yield rates, and/or water quality (i.e. salinity) issues. Altogether, these barriers, costs and water quality challenges may undermine the feasibility of Aboriginal communities' water use and benefit aspirations.

There is also the potential for Aboriginal people to benefit from groundwater through water trade. However, groundwater trading is not as well developed as surface water trading in the MDB, and in some regions, is not possible at all.⁵⁰

Recent Basin developments

Some Basin State governments are coming to appreciate the need for broad and comprehensive responses to the problems facing Aboriginal people in accessing water. For example, the Victorian Government's Aboriginal Water Program, advocates that while Aboriginal water ownership is important, there also needs to be a greater emphasis and investment in other, related areas to support genuine progress and self-determination in Aboriginal water reform including:

1. **Enhancing water literacy** for Traditional Owner and Aboriginal organisations with a particular emphasis on the rules and costs associated storage and delivery of water.
2. **Delivery mechanisms** – given much of the Basin is highly regulated, the ability for Traditional Owners (like the environment) to get water to where they want it may be problematic. They may need to access and/or install pumps, regulators and/or channels to deliver and manage water to achieve the desired outcomes.
3. **Capacity enhancement** within Traditional Owner and Aboriginal organisations so that once they have water, they know their options for using and managing it. This could be cultural, spiritual, environmental, or economic outcomes through on-ground projects and trials.

⁴⁹ These amendments ultimately passed in 2018 and mean that the Basin Plan now has a Basin-wide groundwater SDL that is 40% greater than the BDL (Grafton, 2019).

⁵⁰ See Hartwig (2020) for a review of key opportunities and challenges that Aboriginal entities face when trading surface water, many of which are likely of relevance for groundwater trade.

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4. **Shared benefits** – achieving Traditional Owner and Aboriginal outcomes through the use of other water (e.g. water for the environment). If there are ways of achieving Traditional Owner or Aboriginal outcomes without the trappings of owning water, then those options and opportunities should be made available for Traditional Owners to self-determine if it meets their needs.
 5. **Broader natural resource management (NRM) activities** – many Traditional Owner groups have stated they want greater involvement and influence in NRM activities to complement their use and/or ownership of water. The Victorian Aboriginal Water Program has heard that management of land and water cannot be separated and is part of Traditional Owner fabric. So, more needs to be invested in this area for them to better partner with local NRM bodies.
 6. **Expanding participation and employment in the water sector** for Aboriginal Victorians, with an emphasis on opportunities for Traditional Owners and Aboriginal Victorians in water agency, planning and decision-making.

Victoria's Aboriginal Water Program tackling the above and, according to the Department, is making progress in partnership with Traditional Owner organisations, MLDRIN and the Federation of Victorian Traditional Owner Corporations (Paulo Lay, Principal Manager Community Partnerships, DELWP, *pers comm*, 16 April 2020).

Under the Water for Victoria Plan, the Victorian Government in 2016 made a number of commitments relating to Aboriginal involvement in water planning and water access that have supported this progress. An example resource made available through this funding is the *Water Access for Victorian Traditional Owner Economic Development* program. This work is being undertaken as a co-design process with Traditional Owners, peak bodies (MLDRIN and the Federation of Victorian Traditional Owner Corporations), and the Victorian Government. It will provide a clear statement of Traditional Owner interests in and aspirations for water management, including not only economic development but also for cultural, spiritual, and social purposes (O'Donnell, 2019). This will inform future program development in Victoria.

Additionally, the Queensland Government is developing a process for Aboriginal people to apply for unallocated groundwater that can be used for any purpose as desired and determined by the Aboriginal holders (DNRME, 2019). Work is underway to design and implement the process for granting entitlements from these unallocated reserves to First Nations and is due to be completed within two years of relevant water plans commencing (DNRME, 2019).

We urge other policymakers and government staff such as those at the MDBA and State- and Territory-based water agencies, to pay close attention to the outcomes of these Victorian and Queensland developments. In partnership with First Nations representatives, agency staff should consider the suitability of similar models and key lessons for application elsewhere.

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Appendix A: 2016 population baseline

Table 12: 2016 ERP data for the MDB, by SDL resource units

State	Region	Surface Water SDL resource unit	Code	Indigenous ERP	Total ERP	Proportion of total MDB Indigenous population (%)	Indigenous population as proportion of total SDL resource unit population (%)
Queensland	Northern MDB	Queensland Border Rivers	SS24	1,133	23,010	0.9	4.9
		Moonie	SS25	69	888	0.1	7.8
		Condamine–Balonne	SS26	12,478	216,875	10.4	5.8
		Nebine	SS27	68	1,095	0.1	6.2
		Warrego	SS28	1,138	5,869	0.9	19.4
		Paroo	SS29	24	267	0.0	9.0
New South Wales	Northern MDB	NSW Border Rivers	SS23	3,447	30,951	2.9	11.1
		Gwydir	SS22	4,017	24,810	3.3	16.2
		Namoi	SS21	13,804	98,352	11.5	14.0
		Macquarie-Castlereagh	SS20	25,542	206,042	21.2	12.4
		Intersecting Streams	SS17	3,019	10,905	2.5	27.7
		Barwon-Darling Watercourse*	SS19	n/a	n/a	n/a	n/a
		Lachlan	SS16	8,051	96,223	6.7	8.4
ACT	Southern MDB	NSW Murray	SS14	3,290	98,064	2.7	3.4
		Lower Darling	SS18	3,530	27,854	2.9	12.7
		Murrumbidgee	SS15	13,778	248,170	11.4	5.6
		ACT	SS1	7,456	402,584	6.2	1.9
		Victorian Murray	SS2	4,248	112,235	3.5	3.8
		Kiewa	SS3	1,284	47,875	1.1	2.7
		Ovens	SS4	709	49,996	0.6	1.4
		Broken	SS5	328	18,192	0.3	1.8
		Goulburn	SS6	3,987	138,997	3.3	2.9
		Campaspe	SS7	956	55,911	0.8	1.7
Victoria	Southern MDB	Loddon	SS8	2,863	147,811	2.4	1.9
		Wimmera-Mallee	SS9	1,106	63,491	0.9	1.7
		SA Non-Prescribed Areas	SS10	2,794	63,836	2.3	4.4
		SA Murray	SS11	192	7,519	0.2	2.6
		Marne Saunders	SS12	13	1,453	0.0	0.9
South Australia	Southern MDB	Eastern Mount Lofty Ranges	SS13	1,163	52,848	1.0	2.2

Note: * The Barwon-Darling Watercourse SDL resource unit only includes the watercourse i.e. the river channel, where no one lives.

Table 13: 2016 ERP data for the MDB, by Water Resource Plan area

State	Region	Surface Water Water Resource Plan area	Code	Indigenous ERP	Total ERP	Proportion of total MDB Indigenous population (%)	Indigenous population as proportion of total WRP area population (%)
Qld	Northern Basin	Queensland Border Rivers–Moonie	SW17	1,202	23,898	1.0	5.0
		Condamine–Balonne	SW19	12,478	216,875	10.4	5.8
		Warrego–Paroo–Nebine	SW20	1,230	7,231	1.0	17.0
NSW		NSW Border Rivers	SW16	3,447	30,951	2.9	11.1
		Gwydir	SW15	4,017	24,810	3.3	16.2
		Namoi	SW14	13,804	98,352	11.5	14.0
		Macquarie–Castlereagh	SW11	25,542	206,042	21.2	12.4
		Intersecting Streams	SW13	3,019	10,905	3	27.7
		Barwon-Darling Watercourse*	SW12	n/a	n/a	n/a	n/a
ACT	Southern Basin	Lachlan	SW10	8,051	96,223	6.7	8.4
		NSW Murray and Lower Darling	SW8	6,820	125,918	5.7	5.4
		Murrumbidgee	SW9	13,778	248,170	11.4	5.6
ACT		SW1	7,456	402,584	6.2	1.9	
Vic		Victorian Murray	SW2	4,248	112,235	3.5	3.8
		Northern Victoria	SW3	10,127	458,782	8.4	2.2
		Wimmera-Mallee	SW4	1,106	63,491	0.9	1.7
SA		SA Murray Region	SW5	2,794	63,836	2.3	4.4
		SA River Murray	SW6	192	7,519	0.2	2.6
	Eastern Mount Lofty Ranges	SW7	1,176	54,301	1.0	2.2	

Note: * The Barwon-Darling Watercourse WRP area only includes the watercourse i.e. the river channel, where no one lives.

Table 14: 2016 ERP data for the MDB, by State and Territory portions of the Basin

State or Region	Indigenous ERP	Total ERP	Proportion of total MDB Indigenous population (%)	Indigenous population as proportion of total area population (%)
Queensland*	14,910	248,004	12.4	6.0
New South Wales	78,478	841,371	65.1	9.3
Australian Capital Territory	7,456	402,584	6.2	1.9
Victoria	15,481	634,508	12.8	2.4
South Australia	4,162	125,656	3.5	3.3
Northern MDB (inc Vic in baseline)	64,739	619,064	53.7	10.5
Northern Basin (exc Vic from baseline)	64,739	619,064	61.7	10.5
Southern MDB (inc Vic in baseline)	55,748	1,633,059	46.3	3.4
Southern MDB (exc Vic from baseline)	40,267	998,551	38.3	4.0
TOTAL MDB (inc Vic in baseline)	120,487	2,252,123	100	5.3
TOTAL MDB (exc Vic from baseline)	105,006	1,617,615	100	6.5

Appendix B: 2020 Aboriginal surface water holdings baseline

Table 15: 2020 Aboriginal surface water holdings data, per SDL resource unit

State	Region	Surface Water SDL resource unit	Code	Total water holdings (GL/y) [BDL]	Aboriginal water holdings (standardised) (GL/y)	Aboriginal % of total BDL water holdings (%)	Water recovered for environment (GL/y)	Water recovered for environment as % of BDL (%)	SDL water holdings (GL/y) [SDL]	Aboriginal water holdings (GL/y)	Aboriginal % of water holdings per SDL (%)
Queensland	Northern MDB	Queensland Border Rivers	SS24	246	0	0	13.3	5.4	232.0	0	0
		Moonie	SS25	36.8	0	0	2.5	6.8	34.7	0	0
		Condamine–Balonne*	SS26	601	0	0	87.4	14.5	501.0	0	0
		Nebine	SS27	9.5	0	0	3.8	40.0	5.7	0	0
		Warrego	SS28	59.1	0	0	20.1	34.0	39.0	0	0
		Paroo	SS29	0.2	0	0	0	0	0.2	0	0
New South Wales	Northern MDB	NSW Border Rivers	SS23	204.7	0.030	0.01	1.9	0.9	197.7	0.030	0.02
		Gwydir	SS22	307.4	0.031	0.01	54.6	17.8	257.8	0.031	0.01
		Namoi	SS21	323.7	0.205	0.06	10.5	3.2	303.7	0.205	0.07
		Macquarie-Castlereagh	SS20	424.3	0.047	0.01	95.8	22.6	366.7	0.047	0.01
		Intersecting Streams	SS17	16.8	0.023	0.14	13.8	82.1	3.0	0.023	0.78
		Barwon-Darling Watercourse	SS19	186.5	2.348	1.26	30.1	16.1	154.5	2.348	1.52
		Lachlan	SS16	302.4	0.227	0.08	46.7	15.4	254.4	0.227	0.09
		NSW Murray	SS14	1,707.7	4.225	0.25	292.8	17.1	1392.2	4.225	0.30
		Lower Darling	SS18	55.0	0.902	1.64	23.2	42.2	32.7	0.902	2.76
		Murrumbidgee	SS15	2,117.0	3.954	0.19	435.2	20.6	1547.9	3.954	0.26
		ACT		ACT (surface water)	SS1	42.7	0	0	0	0	37.8
Victoria	Southern MDB	Victorian Murray	SS2	1,662.1	unavailable	unavailable	392.8	23.6	1263.8	unavailable	unavailable
		Kiewa	SS3	11	unavailable	unavailable	0	0	11.1	unavailable	unavailable
		Ovens	SS4	25.4	unavailable	unavailable	0.1	0.4	25.4	unavailable	unavailable
		Broken	SS5	13.2	unavailable	unavailable	0.4	3.0	12.9	unavailable	unavailable
		Goulburn	SS6	1,580.4	unavailable	unavailable	367.9	23.3	1207.0	unavailable	unavailable
		Campaspe	SS7	112.6	unavailable	unavailable	28.9	25.7	83.7	unavailable	unavailable
		Loddon	SS8	88.6	unavailable	unavailable	12.3	13.9	76.6	unavailable	unavailable
		Wimmera-Mallee (surface water)	SS9	68.2	unavailable	unavailable	23.2	34.0	45.2	unavailable	unavailable
South Australia		SA Non-Prescribed Areas	SS10	0	0	0	0	0	0	0	0
		SA Murray	SS11	681.1	0.782	0.11	141	21	542.8	0.782	0.14
		Marne Saunders	SS12	0	0	0	0	0	0	0	0
		Eastern Mount Lofty Ranges	SS13	15.3	0	0	0	0	15.3	0	0

Notes: Water recovered for the environment data from 31 March 2020 (MDBA, 2020b). *Water recovery in the Condamine-Balonne in Queensland is associated with take by floodplain harvesting (Carol Bruce, Assistant Director, Surface Water, SDL Accounting & Aboriginal Partnerships Branch, MDBA, *pers comm*, 6 May 2020). BDL and SDL data is determined using only equivalent takes (i.e. “take from a regulated river” and “take from a watercourse”) and based on 2019/20 water year estimates (MDBA, 2019c, 2019d).

Table 16: 2020 Aboriginal surface water holdings data, per Water Resource Plan Area

State	Region	Surface Water Water Resource Plan area	Code	Total water holdings (GL/y) [BDL]	Aboriginal water holdings (standardised) (GL/y)	Aboriginal % of total BDL water holdings (%)	Water recovered for environment (GL/y)	Water recovered for environment as % of BDL (%)	SDL water holdings (GL/y) [SDL]	Aboriginal water holdings (GL/y)	Aboriginal % of water holdings per SDL (%)
Queensland	Northern Basin	Queensland Border Rivers–Moonie	SW17	282.8	0	0	15.8	5.6	266.7	0	0
		Condamine–Balonne*	SW19	601.0	0	0	87.4	14.5	501.0	0	0
		Warrego–Paroo–Nebine	SW20	68.8	0	0	23.9	34.7	44.9	0	0
New South Wales	Northern Basin	NSW Border Rivers	SW16	204.7	0.030	0.01	1.9	0.9	197.7	0.030	0.02
		Gwydir	SW15	307.4	0.031	0.01	54.6	17.8	257.8	0.031	0.01
		Namoi	SW14	323.7	0.205	0.06	10.5	3.2	303.7	0.205	0.07
		Macquarie-Castlereagh	SW11	424.3	0.047	0.01	95.8	22.6	366.7	0.047	0.01
		Intersecting Streams	SW13	16.8	0.023	0.14	13.8	82.1	3.0	0.023	0.78
		Barwon-Darling Watercourse	SW12	186.5	2.348	1.26	30.1	16.1	154.5	2.348	1.52
		Lachlan	SW10	302.4	0.227	0.08	46.7	15.4	254.4	0.227	0.09
New South Wales	Southern Basin	NSW Murray and Lower Darling	SW8	1,762.7	5.127	0.29	316.0	17.9	1,424.9	5.127	0.36
		Murrumbidgee	SW9	2,117.0	3.954	0.19	435.2	20.6	1,547.9	3.954	0.26
		ACT (surface water)	SW1	42.7	0	0	0	0	37.8	0	0
Victoria	Southern Basin	Victorian Murray	SW2	1,662.1	unavailable	unavailable	392.8	23.6	1,263.8	unavailable	unavailable
		Northern Victoria	SW3	1,831.2	unavailable	unavailable	409.6	22.4	1,416.7	unavailable	unavailable
		Wimmera-Mallee (surface water)	SW4	68.2	unavailable	unavailable	23.2	34.0	45.2	unavailable	unavailable
South Aus.	Southern Basin	SA Murray Region	SW5	0	0	0	0	0	0	0	0
		SA River Murray	SW6	681.1	0.8	0.11	141.0	20.7	542.8	0.8	0.14
		Eastern Mount Lofty Ranges	SW7	15.3	0	0	0	0	15.3	0	0

Notes: Water recovered for the environment data from 31 March 2020 (MDBA, 2020b). *Water recovery in the Condamine-Balonne in Queensland is associated with take by floodplain harvesting (Carol Bruce, Assistant Director, Surface Water, SDL Accounting & Aboriginal Partnerships Branch, MDBA, *pers comm*, 6 May 2020). BDL and SDL data is determined using only equivalent takes (i.e. “take from a regulated river” and “take from a watercourse”) and based on 2019/20 water year estimates (MDBA, 2019c, 2019d).

Table 17: 2020 Aboriginal surface water holdings data, per State and Territory portions of the Basin

State or Region	Total water holdings (GL/y) [BDL]	Aboriginal water holdings (standardised) (GL/y)	Aboriginal % of total BDL water holdings (%)	Water recovered for environment (GL/y)	Water recovered for environment as % of BDL (%)	SDL water holdings (GL/y) [SDL]	Aboriginal water holdings (GL/y)	Aboriginal % of water holdings per SDL (%)
Queensland*	952.6	0	0	127.1	13.3	812.6	0	0
New South Wales	5,645.5	11.992	0.212	1,004.6	17.8	4,510.6	11.992	0.266
Australian Capital Territory	42.7	0	0	0	0	37.8	0	0
Victoria	3,561.5	unavailable	unavailable	825.6	23.2	2,725.7	unavailable	unavailable
South Australia	696.4	0.782	0.112	141.0	20.2	558.1	0.782	0.140
Northern MDB	2,416	2.684	0.11	334	13.8	2,096	2.684	0.13
Southern MDB (inc Vic in baseline)	8,483	10.090	0.12	1,765	20.8	6,549	10.090	0.15
Southern MDB (exc Vic from baseline)	4,921	10.090	0.21	939	19.1	3,823	10.090	0.26
TOTAL MDB (inc Vic in baseline)	10,899	12.774	0.12	2,098	19.3	8,645	12.774	0.15
TOTAL MDB (exc Vic from baseline)	7,337	12.774	0.17	1,273	17.3	5,919	12.774	0.22

Notes: Water recovered for the environment data from 31 March 2020 (MDBA, 2020b). * Water recovery in the Condamine-Balonne in Queensland is associated with take by floodplain harvesting (Carol Bruce, Assistant Director, Surface Water, SDL Accounting & Aboriginal Partnerships Branch, MDBA, *pers comm*, 6 May 2020). BDL and SDL data is determined using only equivalent takes (i.e. “take from a regulated river” and “take from a watercourse”) and based on 2019/20 water year estimates (MDBA, 2019c, 2019d).

Appendix C: 2020 Aboriginal groundwater holdings baseline

Table 18: Key inputs for groundwater workings for SDL resource units

State	SDL resource unit	Code	SDL (GL/y)	Take under basic rights (BR) (GL/y)	Volume of water access entitlements (WAE) (GL/y)	Volume of WAE+BR (GL/y)	Comparison ratio	Available groundwater resource (GL/y)
Queensland	Queensland Border Rivers Alluvium	GS54	14.0	1.09	19.0	20.1	0.70	14.0
	Queensland Border Rivers Fractured Rock	GS55	10.5	0.98	7.8	8.8	1	8.8
	Sediments above the GAB: Border Rivers-Moonie	GS57	46.9	0.27	0.2	0.5	1	0.5
	St George Alluvium: Moonie	GS62	0.69	0.02	0.0	0.0	1	0.0
	Condamine Fractured Rock	GS53	1.48	0.23	0.4	0.6	1	0.6
	Queensland MDB: deep	GS56	100.0	0.00	0.0	0.0	1	0.0
	Sediments above the GAB: Condamine-Balonne	GS58	18.1	0.16	0.3	0.4	1	0.4
	St George Alluvium: Condamine-Balonne (shallow)	GS61a	27.7	0.21	0.1	0.3	1	0.3
	St George Alluvium: Condamine-Balonne (deep)	GS61b	12.6	0.10	11.8	11.9	1	11.9
	Upper Condamine Alluvium (Central Condamine Alluvium)	GS64a	46.0	4.46	83.0	87.4	0.53	46.0
	Upper Condamine Alluvium (Tributaries)	GS64b	40.5	2.63	40.4	43.0	0.94	40.5
	Upper Condamine Basalts	GS65	79.0	13.2	61.1	74.3	1	74.3
	Sediments above the GAB: Warrego-Paroo-Nebine	GS60	99.2	0.59	0.2	0.7	1	0.7
	St George Alluvium: Warrego-Paroo-Nebine	GS63	24.6	0.08	0.0	0.1	1	0.1
Warrego Alluvium	GS66	10.2	0.47	0.3	0.8	1	0.8	
New South Wales	Western Porous Rock	GS50	226.0	26.7	35.9	62.7	1	62.7
	Gunnedah-Oxley Basin MDB	GS17	127.5	5.78	23.6	29.4	1	29.4
	Sydney Basin MDB	GS41	19.1	0.47	5.4	5.9	1	5.9
	Oaklands Basin	GS38	2.50	0.00	0.0	0.0	1	0
	Lower Darling Alluvium	GS23	2.23	0.73	0.9	1.7	1	1.7
	Upper Darling Alluvium	GS42	6.59	2.76	3.5	6.3	1	6.3
	Billabong Creek Alluvium	GS13	7.50	0.64	6.8	7.5	1	7.47
	Lower Murray Shallow Alluvium	GS27a	81.9	0.99	77.8	78.7	1	78.7
	Lower Murray Deep Alluvium	GS27b	88.9	1.53	84.8	86.3	1	86.3
	Upper Murray Alluvium	GS46	14.1	0.40	41.2	41.6	0.34	14.1
	Lake George Alluvium	GS21	1.27	0.03	1.2	1.26	1	1.26
	Lower Murrumbidgee Shallow Alluvium	GS28a	26.9	3.00	5.2	8.2	1	8.2
	Lower Murrumbidgee Deep Alluvium	GS28b	273.6	1.00	275.4	276.4	0.99	273.6
	Mid-Murrumbidgee Alluvium	GS31	53.5	0.82	83.7	84.6	0.63	53.5
	Belubula Alluvium	GS12	2.88	0.04	8.2	8.3	0.35	2.9
	Lower Lachlan Alluvium	GS25	117.0	4.00	108.6	112.6	1	112.6
	Upper Lachlan Alluvium	GS44	94.2	6.28	174.4	180.6	0.52	94.2
	Adelaide Fold Belt MDB	GS10	6.90	2.14	2.2	4.3	1	4.3
	Inverell Basalt	GS18	4.15	1.07	3.1	4.15	1	4.15
	Kanmantoo Fold Belt MDB	GS19	18.7	8.15	0.8	8.9	1	8.9
Lachlan Fold Belt MDB	GS20	259.0	75.5	73.3	148.8	1	148.8	
Liverpool Ranges Basalt MDB	GS22	2.16	1.83	0.4	2.3	0.96	2.16	
New England Fold Belt MDB	GS37	55.1	18.6	22.6	41.2	1	41.2	
Orange Basalt	GS39	10.7	1.16	9.8	11.0	0.98	10.7	
Warrumbungle Basalt	GS49	0.55	0.54	0.1	0.61	0.90	0.55	

State	SDL resource unit	Code	SDL (GL/y)	Take under basic rights (BR) (GL/y)	Volume of water access entitlements (WAE) (GL/y)	Volume of WAE+BR (GL/y)	Comparison ratio	Available groundwater resource (GL/y)
	Young Granite	GS51	7.11	0.76	6.4	7.11	1	7.11
	Bell Valley Alluvium	GS11	3.29	0.01	4.8	4.8	0.69	3.29
	Castlereagh Alluvium	GS14	0.62	0.08	0.6	0.7	0.93	0.62
	Coolaburragundy-Talbragar Alluvium	GS15	3.47	0.07	6.0	6.1	0.57	3.47
	Cudgegong Alluvium	GS16	2.53	0.03	13.7	13.7	0.18	2.53
	Lower Macquarie Alluvium	GS26	52.7	0.55	51.5	52.1	1	52.1
	Upper Macquarie Alluvium	GS45	17.9	0.30	32.2	32.5	0.55	17.90
	NSW GAB Surat Shallow	GS34	15.5	0.98	5.8	6.8	1	6.8
	NSW GAB Warrego Shallow	GS35	33.4	0.65	0.0	0.7	1	0.7
	NSW GAB Central Shallow	GS36	8.83	1.16	0.5	1.6	1	1.6
	Lower Namoi Alluvium	GS29	88.3	3.30	86.0	89.3	0.99	88.3
	Manilla Alluvium	GS30	1.23	0.02	3.5	3.6	0.35	1.23
	Peel Valley Alluvium	GS40	9.34	0.24	51.9	52.2	0.18	9.34
	Upper Namoi Alluvium	GS47	123.4	2.83	116.1	118.9	1	118.9
	Upper Namoi Tributary Alluvium	GS48	1.77	0.03	3.9	3.9	0.45	1.77
	Lower Gwydir Alluvium	GS24	33.0	0.70	32.6	33.3	0.99	33.0
	Upper Gwydir Alluvium	GS43	0.72	0.07	1.2	1.3	0.57	0.72
	NSW Border Rivers Alluvium	GS32	8.40	0.24	15.9	16.1	0.52	8.40
	NSW Border Rivers Tributary Alluvium	GS33	0.41	0.13	1.6	1.7	0.24	0.41
ACT	ACT (Groundwater)	GS52	3.16	0.00	2.2	2.2	1	2.2
Victoria	Goulburn-Murray: Shepparton Irrigation Region	GS8a	244.1	2.50	185.0	187.5	1	187.5
	Goulburn-Murray: Highlands	GS8b	68.7	8.33	29.0	37.3	1	37.3
	Goulburn-Murray: Sedimentary Plain	GS8c	223.0	8.29	205.2	213.5	1	213.5
	Goulburn-Murray: deep	GS8d	20.0	0.11	4.1	4.2	1	4.2
	Wimmera-Mallee: Highlands	GS9a	2.75	0.18	2.4	2.5	1	2.5
	Wimmera-Mallee: Sedimentary Plain	GS9b	186.9	0.87	13.6	14.5	1	14.5
	Wimmera-Mallee: deep	GS9c	20.0	0.00	0.6	0.6	1	0.6
South Australia	Mallee (Pliocene Sands)	GS3a	41.4	0.00	NA	0.0	1	0
	Mallee (Murray Group Limestone)	GS3b	63.6	2.28	61.4	63.6	1	63.6
	Mallee (Renmark Group)	GS3c	2.00	0.00	NA	0.0	1	0
	Peake-Roby-Sherlock (unconfined)	GS5a	3.41	0.19	0.29	0.5	1	0.5
	Peake-Roby-Sherlock (confined)	GS5b	2.58	0.41	1.9	2.3	1	2.3
	SA Murray	GS6	64.8	1.80	NA	1.8	1	1.8
	SA Murray Salt Interception Schemes	GS7	28.6	0.00	NA	0.0	1	0
	Angas Bremer (Quaternary Sediments)	GS1a	1.09	0.00	NA	0.0	1	0
	Angas Bremer (Murray Group Limestone)	GS1b	6.57	0.08	9.0	9.0	0.73	6.57
	Eastern Mount Lofty Ranges	GS2	38.5	0.70	31.9	32.6	1	32.6
	Marne Saunders (Fractured Rock)	GS4a	2.09	0.09	2.0	2.07	1	2.07
	Marne Saunders (Murray Group Limestone)	GS4b	2.38	0.18	2.1	2.26	1	2.26
		Marne Saunders (Renmark Group)	GS4c	0.50	0.0	NA	0.0	1

Note: WAE and BR volumes are from 2018-19 data. Aboriginal groundwater holdings data is not presented at this level in the interest of confidentiality.

Table 19: 2020 Aboriginal groundwater holdings data, per Water Resource Plan Area

State	Groundwater Water Resource Plan area	Code	SDL (GL/y)	Take under basic rights (BR) (GL/y)	Volume of water access entitlements (WAE) (GL/y)	Volume of WAE+BR (GL/y)	Comparison ratio	Available groundwater resource (GL/y)	Aboriginal groundwater entitlements (GL)	Comparable volume of Aboriginal groundwater entitlements (GL)	Comparable volume of Aboriginal groundwater entitlements as a % of available groundwater resource (%)
Qld	Queensland Border Rivers– Moonie	GW19	72.1	2.4	27.1	29.5	1	27.1	0	0	0
	Condamine-Balonne	GW21	325.4	21.0	197.1	218.1	1	197.1	0	0	0
	Warrego–Paroo–Nebine	GW22	134.0	1.1	0.4	1.6	1	0.4	0	0	0
NSW	NSW Murray-Darling Basin Porous Rock	GW6	375.1	33.0	64.9	97.9	1	97.9	0	0	0
	Darling Alluvium	GW7	8.8	3.5	4.5	7.9	1	7.9	0	0	0
	Murray Alluvium	GW8	192.4	3.5	210.6	214.1	0.90	192.4	0	0	0
	Murrumbidgee Alluvium	GW9	355.3	4.8	365.6	370.4	0.96	355.3	0	0	0
	Lachlan Alluvium	GW10	214.1	10.3	291.2	301.5	0.71	214.1	0.059	0.042	0.020
	NSW Murray-Darling Fractured Rock	GW11	364.4	109.7	118.6	228.3	1	228.3	0.240	0.240	0.105
	Macquarie-Castlereagh Alluvium	GW12	80.5	1.0	108.8	109.8	0.73	80.5	0.039	0.029	0.036
	NSW Great Artesian Basin Shallow	GW13	57.7	2.8	6.3	9.1	1	9.1	0	0	0
	Namoi Alluvium	GW14	224.0	6.4	261.4	267.8	0.84	224.0	0.218	0.182	0.081
	Gwydir Alluvium	GW15	33.7	0.8	33.8	34.6	1	34.6	0	0	0
	NSW Border Rivers Alluvium	GW18	8.8	0.4	17.5	17.9	0.49	8.8	0	0	0
ACT	ACT (groundwater)	GW1	3.16	0.00	2.2	2.2	1	2.2	0	0	0
Vic	Goulburn-Murray	GW2	555.8	19.2	423.3	442.5	1	442.5	unavailable	unavailable	unavailable
	Wimmera-Mallee (groundwater)	GW3	209.7	1.0	16.6	17.6	1	17.6	unavailable	unavailable	unavailable
SA	SA Murray Region	GW4	206.4	4.68	63.6	68.24	1	68.2	0	0	0
	Eastern Mount Lofty Ranges	GW5	51.1	1.05	44.9	45.98	1	46.0	0	0	0

Note: WAE and BR volumes are from 2018-19 data.

Table 20: 2020 Aboriginal groundwater holdings data, per State and Territory portions of the Basin

State or Region	SDL (GL/y)	Take under basic rights (BR) (GL/y)	Volume of water access entitlements (WAE) (GL/y)	Volume of WAE+BR (GL/y)	Comparison ratio	Available groundwater resource (GL/y)	Aboriginal groundwater entitlements (GL)	Comparable volume of Aboriginal groundwater entitlements (GL)	Comparable volume of Aboriginal groundwater entitlements as a % of available groundwater resource (%)
Queensland*	531.5	24.4	224.7	249.1	1	249.1	0	0	0
New South Wales	1,914.9	176.3	1,483.1	1,659.4	1	1,659.4	0.556	0.556	0.034
Australian Capital Territory	3.16	0.00	2.2	2.2	1	2.2	0	0	0
Victoria	765.5	20.3	439.8	460.1	1	460.1	unavailable	unavailable	unavailable
South Australia	257.5	5.7	108.5	114.2	1	114.2	0	0	0
TOTAL MDB (inc Vic in baseline)	3,472.5	226.8	2,258.3	2,485.0	1	2,485.0	0.556	0.556	0.022
TOTAL MDB (exc Vic from baseline)	2,707.0	206.5	1,818.5	2,024.9	1	2,024.9	0.556	0.556	0.027

Note: WAE and BR volumes are from 2018-19 data.

Appendix D: Population estimate methodology

Dr Francis Markham from the Australian National University's Centre for Aboriginal Economic Policy Research (CAEPR) provided estimates of the Indigenous and non-Indigenous populations within the MDB. These were based on 2016 Estimated Residential Population (ERP) data published by the ABS. Estimated Residential Population data are not raw Census counts, but the population estimate once the ABS attempts to adjust for those missed by the Census (see Markham & Biddle, 2018).

Understanding the difference between Census counts and the Estimated Residential Population

It is important to understand the difference between the ERP and the raw Census population count, as these vary substantially for the Indigenous population in Australia. The raw Census count of the Indigenous population is produced by tabulating all the individuals about whom the question "Is the person of Aboriginal or Torres Strait Islander origin?" was answered in the affirmative on their household census form. In the 2016 Census, 590,056 people were counted as Aboriginal, 32,345 were counted as Torres Strait Islander, and 26,767 were counted as both Aboriginal and Torres Strait Islander. Combined, 649,168 people were counted as Indigenous (Markham & Biddle, 2017).

However, Census counts are a poor measure of the Indigenous population for three main reasons. First, around 6% of census records do not have a response to the Indigenous status question indicated (i.e. Indigenous status "not stated"). This is primarily because no Census form was received from an occupied dwelling, but Census collectors "imputed" the presence of residents. It also occurs when the Indigenous status question is skipped over on the Census form. Second, some individuals have no record in the Census, not even an imputed one. This could be because they were incorrectly omitted from a completed Census form, because Census collectors missed their dwelling, or because Census collectors mistakenly thought their dwelling was unoccupied. Third, some people who have completed the Census question on Indigenous status may not disclose their Indigeneity, either as an intentional act of refusal (Andrews, 2018) or simply in error.

For this and other reasons, the ABS undertake a post-enumeration survey (PES) in the months after the Census is conducted. The PES is a household sample survey conducted by interviewers who can spend more time and effort to produce a high-quality population estimate. Around 0.5% of Australian households are reinterviewed for PES. The ERP is a survey-based estimate based on the PES (and a number of other minor adjustments that have little effect on Indigenous population estimates). The final Indigenous ERP in 2016 was 798,400 (ABS, 2019).

In other words, the ABS estimate that some 17.5% of Australia's Indigenous population are missed by the Census counts. This high Indigenous undercount has been longstanding for several decades and is not well understood (Markham & Biddle, 2018). The non-Indigenous undercount is much less substantial. For this reason, the ERP should be favoured when producing Indigenous population estimates.

Methods for producing ERPs for Surface Water SDL resource units

Markham tabulated the ERP data as per Surface Water SDL resource units (published March 2019, see MDBA, 2019e). Because the ERP is based on a sample survey, the smallest area for which Indigenous ERPs can be made by the ABS is the SA2. The ERPs were estimated using the following method:

1. SA2-based Indigenous versus non-Indigenous ERPs were obtained from the ABS website (ABS, 2018b).

2. SA2 ERPs were imputed for those few SA2s the ABS censored or did not include in these tables (i.e. SA2s in Other Territories including Jervis Bay, and non-geographic SA2s).

3. SA2-level undercount ratios were calculated by comparing SA2 ERPs and SA2 counts created by aggregating SA1-level Indigenous / non-Indigenous census counts (tabulated by place of usual residence).

3. The SA2-level undercount rates were applied to the SA1-level counts to produce SA1 pseudo ERPs.

4. An SA1 to MDB allocation table was produced by associating each SA1 with a single MDB Surface Water SDL resource unit. A GIS was used to produce an intersection table, showing the geographical area of each SDL resource unit that each SA1 overlapped. Each SA1 was assigned to the SDL resource unit that it had the greatest spatial overlap with. While the vast majority of SA1s only overlap a single SDL resource unit, this method was used to determine the allocation of SA1s on the border between two or more SDL resource units.

5. Surface Water SDL resource unit ERPs were tabulated by summing up the SA1 “pseudo ERPs” according to this SA1-based allocation table.

We acknowledge that there will be small errors associated with all of these steps, but they should be negligible at this level of analysis. These errors are smaller in magnitude than those in previously published estimates by Taylor and Biddle (2004), for example.

Appendix E: Limitations and assumptions to standardising surface water entitlements

While MDBA managers advised that using long-term diversion limit equivalence (LTDLE) factors would be the best way to compare water holdings with and across water sources, and within and across states, there are several assumptions and limitations to this method that must be acknowledged. Those detailed here focus only on those that are relevant to standardising Aboriginal water entitlements, but further assumptions and limitations about LTDLE factors more broadly are detailed in individual State-based LTDLE reports (for example, see NSW Department of Industry 2018a, 2018b, 2019a, 2019b; SA DEW, 2019; Victoria DELWP, 2019).

First concerns LTDLE factors for unregulated entitlements. Water access and extraction in unregulated systems has a unique history. Diversions are small in scale and water use was not metered until recently (NSW Department of Industry, 2018a). Because of this, “[n]o model and no historical record [is] available for estimating [LTDLE] take” under these entitlements in ways that are akin to regulated systems (NSW Department of Industry, 2018b, p. 42). Additionally, LTDLE factors are only developed for entitlement types that have been, or are proposed to be, recovered for environmental use through direct purchases or water savings infrastructure projects (SA DEW, 2019), which often has not included unregulated entitlements. In NSW, the NSW Department of Industry (2018b) nominated a LTDLE factor of 1.000 for unregulated entitlement types that have been recovered for environmental use. This assumption is deemed appropriate because only a very small volume of unregulated water has been recovered for environmental use, and so “the associated factors don’t significantly affect the overall water recovery balance” (NSW Department of Industry, 2018a, p. 1). For the unregulated entitlements held by Aboriginal organisations without applicable LTDLE factors, we followed this assumption and similarly adopted a factor of 1.000. Other methods to establish new LTDLE factors for these sources are in development (NSW Department of Industry, 2018a) and should be adopted into the future.

Second, each LTDLE factor is *representative* of the average behaviour of *all* users or holders of the particular entitlement type based on long-term (i.e. historic) and *average* water use trends (NSW Department of Industry, 2018b, emphasis added). As such, they do not describe *actual* water use associated with specific entitlements, do not impact on water allocations (which are determined by state governments based on climatic and storage conditions), and do not predict future water use or behaviours (NSW Department of Industry, 2018b; SA DEW, 2019). These distinctions are important. Unrelated to these calculated LTDLE factors, it is possible for long-term water use to increase over time (MDBA, 2019b). The MDBA (2019b) has developed a *Sustainable Diversion Limit Reporting and Compliance Framework* to guide monitoring long-term water use trends, which includes specific mechanisms to address situations in which “growth-in use” trends are observed.

Third, this method relies upon calculated LTDLE factors, BDLs and SDLs, which are determined using the best information available (SA DEW, 2019). However, as new and improved information and modelling continue to come to light and efficiency projects continue to be developed, it is likely that LTDLE factors, BDLs and SDLs values may change through to 2024 (MDBA, 2020a). Where this occurs, some figures calculated for this report could also be slightly affected too.

Appendix F: Estimating market value of Aboriginal-held water entitlements

There are multiple water valuation methodologies (see Seidl et al., 2020) as well as variations in water pricing and sales which, together, create complexities for estimating and comparing market value estimates of water. That is, the dollar value of 1 ML of water in both the entitlement and allocation markets differs across water sources, as well as total sale volume, due in large part to regional differences in supply versus demand. For clarity and transparency (Seidl et al., 2020), we detail the method used for this valuation here, along with some associated assumptions and limitations. We reiterate that these valuations are estimates only, although believe them to be reasonable and justifiable given the available data.

To construct market value estimates, we sought out a data source that, for a single water year, included both:

1. an overall market value of all entitlements on issue across the Basin; and,
2. market values for individual entitlement types across the MDB including most, if not all, of those that are held by Aboriginal organisations (see Table 21 below).⁵¹

Data collected and compiled by BOM (2020) and ABARES (2018a) for the water year 2015-16 best met these criteria, though were not perfect as we consider below. While more recent data were available from ABARES (2018b) and BOM (2019) for individual entitlements on issue, a comparable overall estimate of water entitlement market value was not included in this report, and thus did not meet the first criterion. We also considered annual water market reports produced by consultants, Aither, especially as these include more recent data (see for example Aither, 2019). However, these reports focus on the value of the overall market and individual entitlements only within the southern MDB. This is indeed where most water trade in Australia occurs. For example, ABARES (2018a) estimated that in 2015-16, 81% of all Australian water trade occurred in this region. But several key Aboriginal-held water entitlement types are excluded by this focus. Thus, this data source did not meet the second criterion.

Table 21 lists all the Aboriginal-held entitlement types, together with relevant 2015-16 market pricing estimates, specifically, the volume-weighted average prices (VWAP), as calculated by BOM (2020). Where 2015-16 VWAPs were not available from this source—because an insufficient number of trades occurred in that water year—we calculated a VWAP for a 10-year period, where possible. Entitlements for which neither of these methods rendered a VWAP might be considered to be a part of a thin or illiquid market, and the absence of quality data for these entitlements is a known challenge (Seidl et al., 2020) particularly for some unregulated surface water and groundwater markets.⁵² We multiplied these VWAPs by water entitlement volumes (rather than LTDLE volumes) because this is consistent with water entitlement sale processes.

⁵¹ Excluding stock and domestic entitlements because they are not really considered part of the market and therefore the market's value.

⁵² Seidl et al. (2020) report that some water valuing practitioners address this by “using water trade data from comparable water products in other regions (based on reliability) or property sales data” (p. 5), but we have not deployed such an approach here. Instead, the valuation estimates we provide are noted to be minimum estimates.

Table 21: VWAPs used to estimate the market values of Aboriginal water holdings

Water source*	Entitlement type	Volume-weighted average price (\$/ML)	
		2015-16 VWAP	10 years (08-09 to 17-18)
Lachlan	GS	563.25	
Lower Darling	GS	1504.73	
Macquarie	GS	1,020.33	
Murrumbidgee	GS	1,235.20	
NSW Murray	GS	1,045.94	
Peel	GS	1,392.56	
Lachlan	HS	1,335.02	
Murrumbidgee	HS	3,339.66	
NSW Murray	HS	2,642.45	
Macquarie	SW	-	-
NSW Murray	SW	-	-
Murrumbidgee	SW (Lowbidgee)	-	-
Intersecting Streams*	UR	-	-
NSW Border Rivers*	UR	-	-
Macquarie*	UR	-	672.32
Gwydir*	UR	-	-
NSW Murray*	UR	-	332.91
Lachlan*	UR	-	-
Barwon-Darling	UR	748.1	
South Australian Murray	Class 3	2,189.18	
South Australian Murray	Class 5	4,390.17	
Lachlan Alluvium*	AQ	737.36	
Macquarie-Castlereagh Alluvium*	AQ	1082.97	
Namoi Alluvium*	AQ	1660.82	
NSW MDB Fractured Rock*	AQ	1354.20	

Source: Compiled from BOM (2020)

Notes: VWAP: Volume-weighted average price. GS: General Security entitlement. HS: High Security entitlement. SW: Supplementary Water entitlement. UR: Unregulated entitlement. AQ: Aquifer entitlement. *In the interest of confidentiality, rather than specific water sources, most UR are listed by SDL resource unit names and all AQ are listed by WRP area names.

There are limitations inherent in using 10-year VWAP measures. However, with no substitute available, we deemed this to be the best method. For example, an Aboriginal entity holds sizeable General Security entitlements in the Lower Darling, and so their inclusion in the overall Aboriginal water holdings value estimate was highly desirable. However, searching the NSW Water Register revealed there was not a single year between 2004-05 and 2017-18 when sufficient water trades occurred (minimum 10) for BOM to calculate a VWAP for this entitlement category. Recognising these limitations, the VWAPs provided are best regarded as an indicator of pricing that can be used to *estimate* the value of entitlement holdings.

ABARES's (2018a) overall estimated market value of water entitlements (of at least A\$16.5 billion) includes both surface and groundwater entitlements across *all* Basin states (though only those considered "actively traded"). Caution must be observed, therefore, when comparing surface water

only and groundwater only estimates with this baseline. Finally, the value of water entitlements varies inter and intra annually based on market forces, making a static price for valuation purposes impossible.

Appendix G: Alternative options for First Nations to access, use and benefit from water in the MDB

Outside of holding mainstream water entitlements, which is the focus of this report, First Nations may access, use, and benefit from water in other ways. Table 22 summarises some examples of these alternative options across the Basin. This includes a mixture of Indigenous-specific entitlements or other arrangements, some of which are available now and others which under development. Of note, just because an alternative option is listed as “available now” does not necessarily mean that Aboriginal peoples have, to date, benefited from water in that way. Further research into experiences of trying to uptake or use these alternative options is needed.

Table 22: Examples of alternative options for First Nations to access, use, and benefit from water in the Basin

State or Territory portion of the Basin	Means of water access and/or use	Indigenous-specific	Available now	Under development	Use conditioned
Queensland	Unallocated water reserves in some surface water and aquifer systems: reserves for Aboriginal people specifically, and general reserves for ‘any’ applicant	√ [^]		√	
	Aboriginal party or Torres Strait Islander parties can take or interfere with water for traditional activities of cultural purpose (<i>Water Act 2000</i> s 95)	√	√		√
NSW*	Specific-purpose Cultural Access Licences	√	√		√
	Aboriginal Environmental Water Licences (<i>Barwon-Darling</i> only)	√	√		√
ACT	WRP commitments on water entitlements	√ [^]		√	TBD
Victoria (see O’Bryan, 2019)	Rights to take and use water for traditional purposes (<i>Water Act 1989</i> s 8A). Introduced in response to the introduction of <i>Traditional Owner Settlement Act 2010</i>	√	√		√
	Rights to take and use water as a subset of natural resources, for traditional purposes (<i>Traditional Owner Settlement Act (Vic)</i> s 84(a))	√	√		√
Basin-wide	Native title (some States also provide for in State-based water legislation, but not all)	√	√		√
	Stock and domestic use rights (different to water entitlements) that come with being a landholder or occupier, in accordance with State and Territory water legislation		√		√
	ILSC purchasing and lending programs	√ [^]		√	TBD
	Self-funded purchase on the open market		√		
	Co-management of environmental water (see earlier section on this)		√		√

*Other Indigenous-specific water entitlements are available in NSW but not within the MDB. See Tan and Jackson (2013).

[^]Program or arrangement are Indigenous-specific but the water entitlements themselves may not necessarily be.

Of note, where arrangements are Indigenous-specific, available water is often conditioned to be for “traditional” and/or “cultural” uses, and sometimes significantly so (see Jackson & Langton, 2012). In

the Queensland portion of the Basin, such use conditions were originally proposed for a portion of unallocated water (where available) that was to be strategically reserved for Aboriginal peoples. However, through consultation with First Nations, this has changed. Now, the portion of unallocated water that is to be reserved specifically for Aboriginal peoples will be issued as water entitlements that can be used for any purpose as desired and determined by the Aboriginal holders including economic, social, environmental, and/or cultural purposes (see DNRME, 2019).